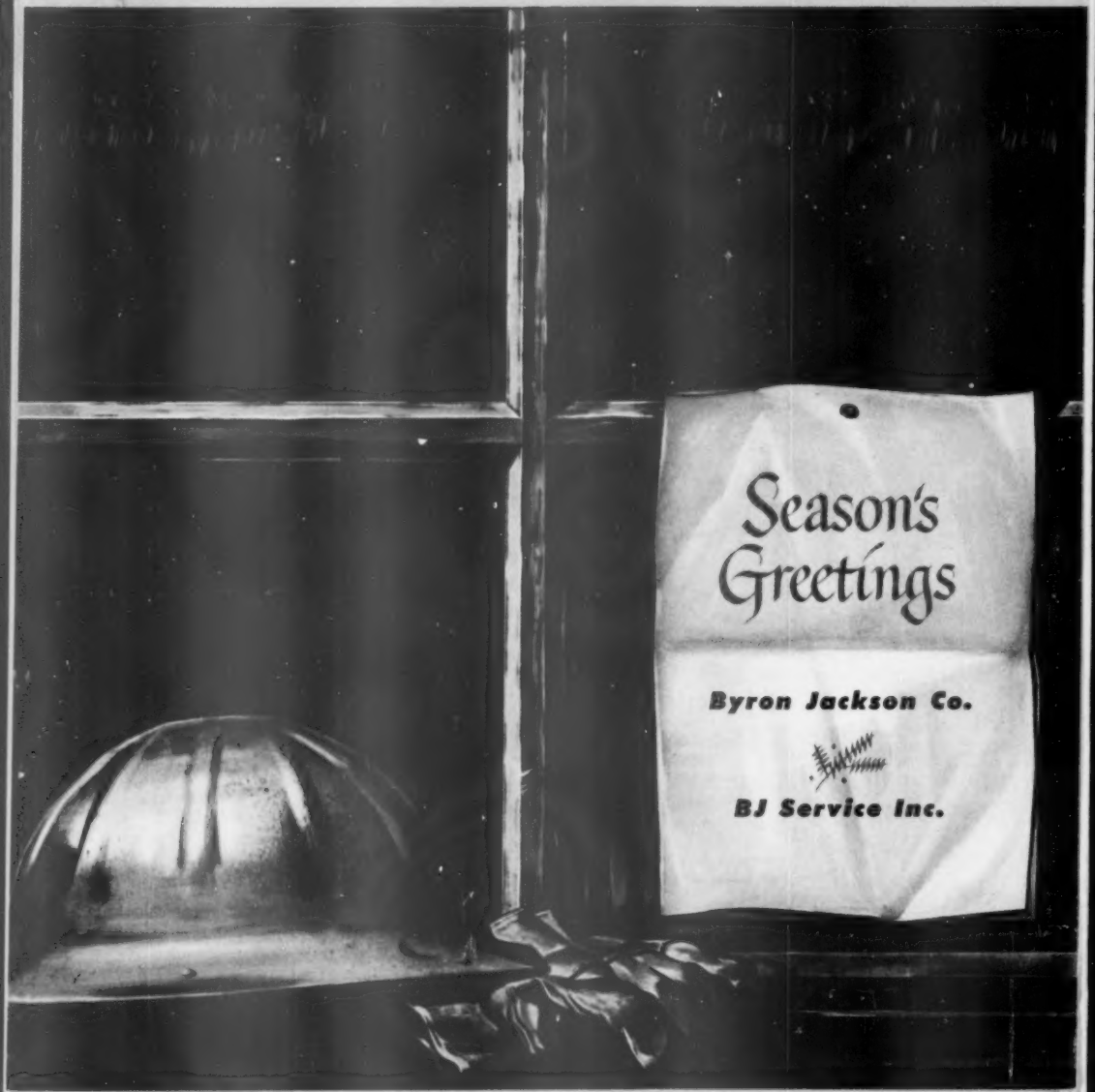
the OIL AND GAS JOURNAL

REPORT ON INTERNATIONAL OIL



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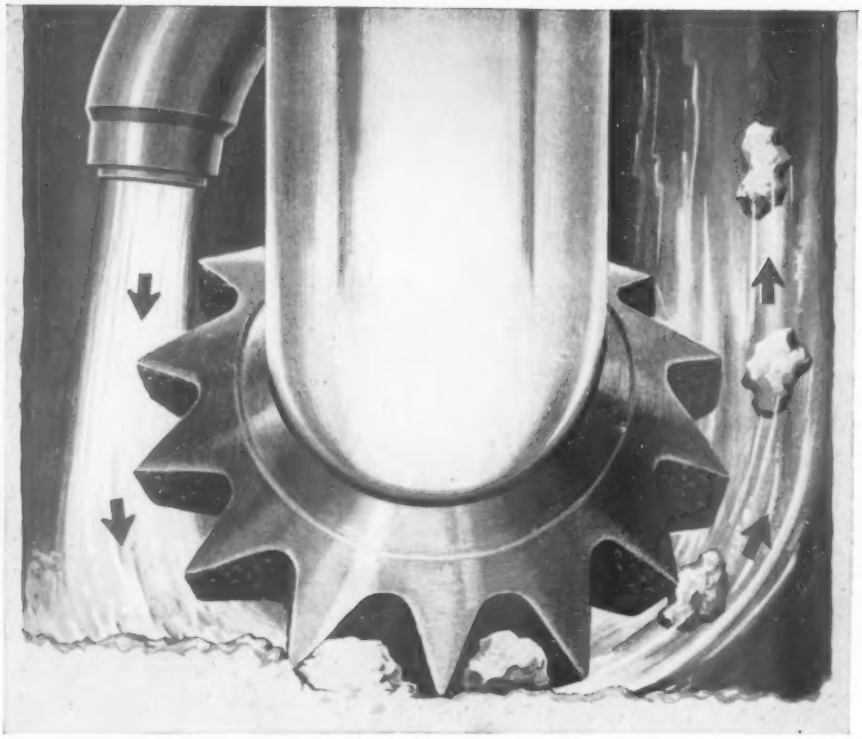

This mud flow pattern makes faster drilling possible

Slush from the nozzles of **REED** Twin-Blast Rock Bits blasts against the bottom of the hole and sweeps across at high velocity — carrying cuttings up into the return mud stream immediately so cutter teeth can work on virgin formation.

The result of this efficient bottom hole cleaning action is faster drilling, more hole per bit, fewer round trips and lower drilling costs.

REED ROLLER BIT COMPANY
Houston 1, Texas

2777

THE OIL AND GAS
JOURNAL
Vol. 51, No. 33

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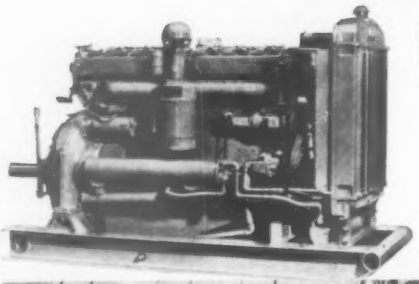
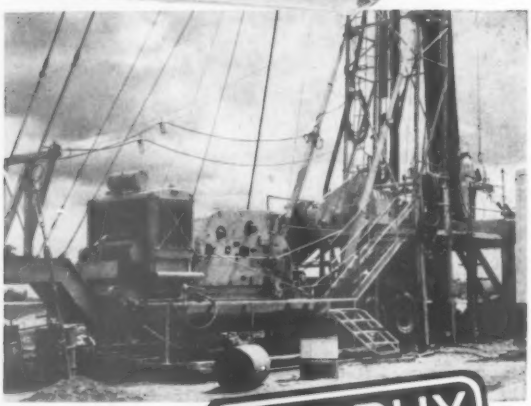
Here's why

MURPHY DIESELS

put more power into your job with longer life and less maintenance





Cardwell Model L Trailermast servicing unit owned by Redwell Servicing Co., Edmonton, Alberta, Canada. It is powered by a Murphy Diesel rated at 125 H.P. continuous 140 H.P., intermittent.

MURPHY DIESEL

THE power a diesel engine develops is dependent to a great degree on the breathing capacity of the valves. Breathing capacity of the valves in turn is determined by the circumference of the valves and their lift. Thus, when we compare Murphy Diesel's 4 valve design with the conventional 2 valve design of equal total valve area, simple arithmetic shows that total circumference of the 4 valve arrangement is 41.4% greater. With equal lift, the breathing capacity is also 41.4% greater.

At the same time, Murphy design provides 41.4% more metal-to-metal contact between the circumference of the valve and the seat for dissipation of valve heat. This, coupled with the smaller valve radius in 4 valve design (which means the heat has a shorter distance to travel to escape), explains why Murphy valves run cooler and rarely, if ever, have to be ground.

Four valves per cylinder is just one of the many reasons for Murphy's high standards of performance and economy. Others are given in the booklet "10 Questions to Ask a Diesel Engine Salesman". Get a copy from your Murphy Diesel Dealer or write direct.

Heavy duty power
for the oilfields

Murphy Diesel Engines and Power Units for drilling and pipe line pumping, 90 to 226 H.P., 1200 and 1400 RPM. Generator Sets, 60 to 140 K.W. Dual-Fuel Engines, 135 to 180 H.P. Also Crude Oil Burning Engines.

222

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Sales, Parts and Service: Los Angeles and Bakersfield, California; Denver, Colorado; Evansville, Indiana; Great Bend, Kansas; Monroe and New Orleans, Louisiana; Butte and Great Falls, Montana; Albuquerque, New Mexico; Amarillo, Dallas, Houston, Lubbock and San Antonio, Texas; and Edmonton, Alberta, Canada.

Only B. F. Goodrich makes the grommet belts that cut costs 20 to 50%!

Save 3 ways! Investigate today! Write or mail coupon

You save belt costs because belts last longer, save production costs because machines keep running with fewer interruptions, save maintenance costs because they need less attention.

Patented grommet belts by B. F. Goodrich represent the only basic change since invention of the V belt. Belts last 20 to 50 per cent longer, depending on service. (The more severe the service, the greater the increase over ordinary belts.) Grommet belts have more rubber; they're more flexible, give better grip, less slip.

What is a grommet?

A grommet is like a giant cable except that it's *endless*—a cord loop built up by winding heavy cord on itself. There is no overlapping cord *section* as in all ordinary belts. Most belt failures occur in these sections where cords overlap!

All cords put to work

Each of the two grommets and every part of a grommet carry their share of the load. In ordinary belts under high tension the center cords "dish" because tension is greater near the driving faces. Dished cords are doing less work, not pulling their share. Grommet belts have no center cords, there is no dishing—therefore much more strength in proportion to cord volume—and less stretch. Grommet belts stretch, on an average, only about one-third as much as ordinary belts.

Better grip, less slip

Grommet belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip, there is also less surface wear.

Send for proof

Send the coupon for a set of reports telling users' experiences and showing actual installations where grommet belts outlasted others. Some typical cases:

"... within a few days ordinary belts had stretched ... After six months of 24-hour-a-day service BFG grommet belts haven't stretched at all ..."

"Ordinary belts lasted only 5 or 6 weeks ... B. F. Goodrich grommet belts are in their sixth month of service ..."

"Previous belts suffered from shock loads, wore out fast ... BFG grommet belts have been in service 2 years with no shut-downs..."

There are hundreds of cases like these.

They cost no more

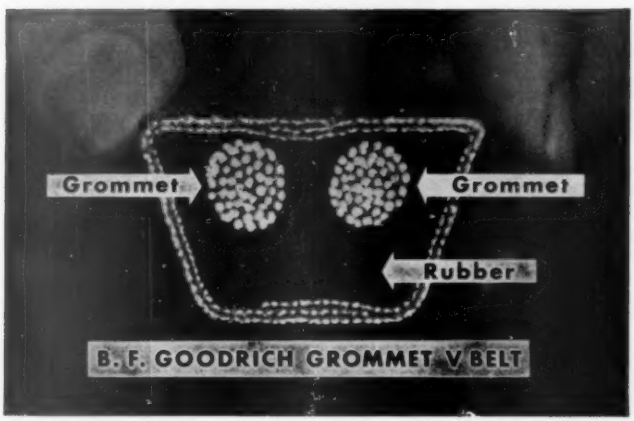
BFG grommet belts cost not one cent more than others. The savings they make for you are clear profit. They are made in C, D and E sections. They are patented by B. F. Goodrich. No other V belt is a grommet belt (U. S. Patent No. 2,233,294).

Write, send the coupon or see your B. F. Goodrich distributor. (He will show you his "X-ray" belt that shows the grommet construction clearly.)

Grommet V-Belts BY

B.F.Goodrich

FIRST IN RUBBER



The B. F. Goodrich Company
Dept. OJ-12
Akron, Ohio

☐ Send set of reports telling users' experiences and showing actual installations proving that B. F. Goodrich grommet belts outlast all others.

☐ Have distributor show me the "X-ray" belt that shows how B. F. Goodrich grommet belts are made.

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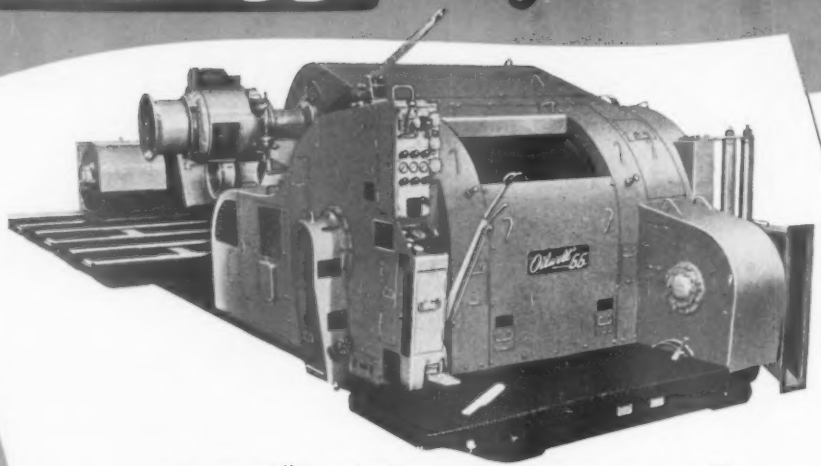
"Oilwell" 66

NAMEPLATE for a great new RIG



"OILWELL'S" No. 66 Rig..for 4,500 to 7,500 ft. drilling
"OILWELL'S" No. 76 Rig..for 7,000 to 10,000 ft. drilling
"OILWELL'S" No. 96 Rig..for drilling beyond 10,000 ft.

. . . added to the "Oilwell" Line for

MEDIUM DEPTH DRILLING

"OILWELL'S" No. 66 Draw Works and companion No. 550 Drive is a compact rig—embodying the latest design features and is adapted for two or three engines and one or two pump drives. In this one rig, an operator has a choice of either a straight mechanical draw works or a torque convertor rig. By a simple change, possible in the field, the draw works can be changed from six speeds forward to three speeds forward when using torque convertor equipped engines. This rig also has the many field proven features which have contributed so much to the ease of handling and the outstanding performance of larger "Oilwell" rigs.

With or Without Torque Convertor

The No. 66 Draw Works has a selection of six forward and one reverse drum speed with three forward and one reverse rotary speed.

The No. 63-T Draw Works for use with two or three torque-convertor-equipped engines, has three forward and one reverse drum speeds and three forward and one reverse rotary speeds.

These rigs are basically the same and can easily be converted from one type to the other. Both rigs have a built-in, high-speed, high-capacity hydromatic brake. The draw works can be assembled as a unit with the drive and can be moved complete with engines; or when desired, the drive with engines can be separated from the draw works for moving separately.

Ask . . . your "Oilwell" Representative for all the facts about this newest "Oilwell" Rig—or write for your copy of Booklet No. 1-53.

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WALWORTH VALVES
for the OIL AND GAS INDUSTRIES

The Walworth Company – with over 100 years of valve manufacturing experience – has supplied valves to the petroleum industry since Colonel Edward L. Drake first struck oil in Titusville, Pa. Men who have grown up with the oil and gas industries throughout the world know that they can count on Walworth to furnish the right valves for their services.

The valves and fittings illustrated are typical of the approximately 50,000 items that comprise Walworth's complete line of steel, iron, bronze and special alloy valves, pipe fittings, and pipe wrenches.

WALWORTH

valves...fittings...pipe wrenches
60 East 42nd Street, New York 17, N. Y.

Distributors in principal centers throughout the world.

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PUTTING THE SUPER INCH TO BED

From Needles on the Arizona border to Milpitas in Santa Clara County, California's 501-mile Super Inch has recently joined a 1,600-mile system bringing natural gas from Texas and New Mexico. The stretch you see here is near Llanada, Calif., where Bechtel-Price-Conyes of San Francisco used a "Caterpillar" Diesel D8 Tractor with No. 8S Bulldozer for backfilling. This big yellow team tucks in the 34" pipe neatly and quickly, helping to wrap up a 63 million dollar job.

The Super Inch cut its way through all kinds of country, some of it steep, some of it sandy, all of it rough. The "Cat" 8S 'Dozer is right at home on jobs like this. Its side arms are of rugged box-section construction. Its scientifically curved blade rolls the load ahead smoothly, while its high carbon steel cutting edge combines just the right degrees of hardness and toughness. Its cable controls give accurate, smooth operation under the severest conditions. And it adjusts easily for tilt and pitch.

There's a "Caterpillar" Bulldozer for any job, built to match its running mate, the brawny Diesel Tractor. And there's a "Caterpillar" Dealer nearby with all the information you want. See him now.

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

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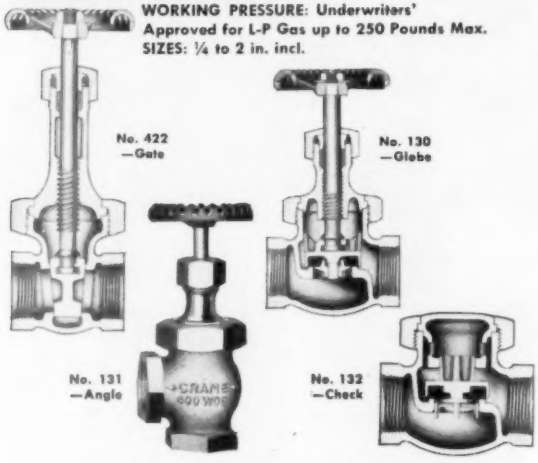
DIESEL ENGINES
TRACTORS • MOTOR GRADERS
EARTHMOVING EQUIPMENT

For BIG Selection in L-P Gas Piping Equipment See the CRANE Line First

BRASS VALVES



WORKING PRESSURE: Underwriters' Approved for L-P Gas up to 250 Pounds Max. SIZES: ¼ to 2 in. incl.

No. 422 —Gate

No. 130 —Globe

No. 131 —Angle

No. 132 —Check

Globe and Angle Valves have composition disc with easy-to-change slip-on disc connection.

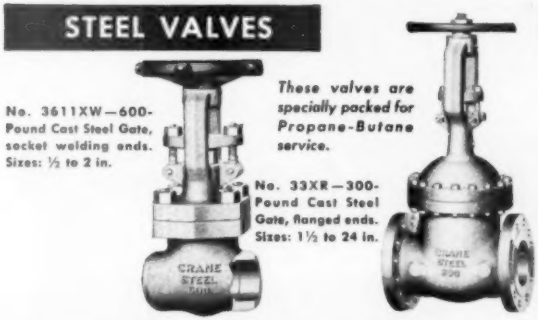
For producer, distributor, and large user—for every need in L-P Gas handling—Crane is where you get the BIG selection of quality piping materials.

You'll have your choice of valves, pipe fittings, and unions in service approved design, in brass, steel and iron.

With the help of Crane Co.'s accurate service recommendations, you'll enjoy maximum safety and dependability in L-P Gas piping, with low ultimate piping equipment costs. With Crane Quality in every item, you'll be protected against high maintenance expense.

See the big selection you get—in your Crane Catalog, or talk it over with your local Crane Representative.

STEEL VALVES



No. 3611XW—600-Pound Cast Steel Gate, socket welding ends. Sizes: ½ to 2 in.

These valves are specially packed for Propane-Butane service.

No. 33XR—300-Pound Cast Steel Gate, flanged ends. Sizes: 1½ to 24 in.

FITTINGS AND UNIONS

No. 198E—300-Pound Malleable Iron Female Union. Sizes: ⅛ to 4 in.

No. 260E—300-Pound Malleable Iron 90° Elbow. Sizes: ¼ to 6 in.

No. 1240—2000-Pound Forged Steel Socket Welding Elbow. Sizes: ⅛ to 4 in.

CRANE VALVES

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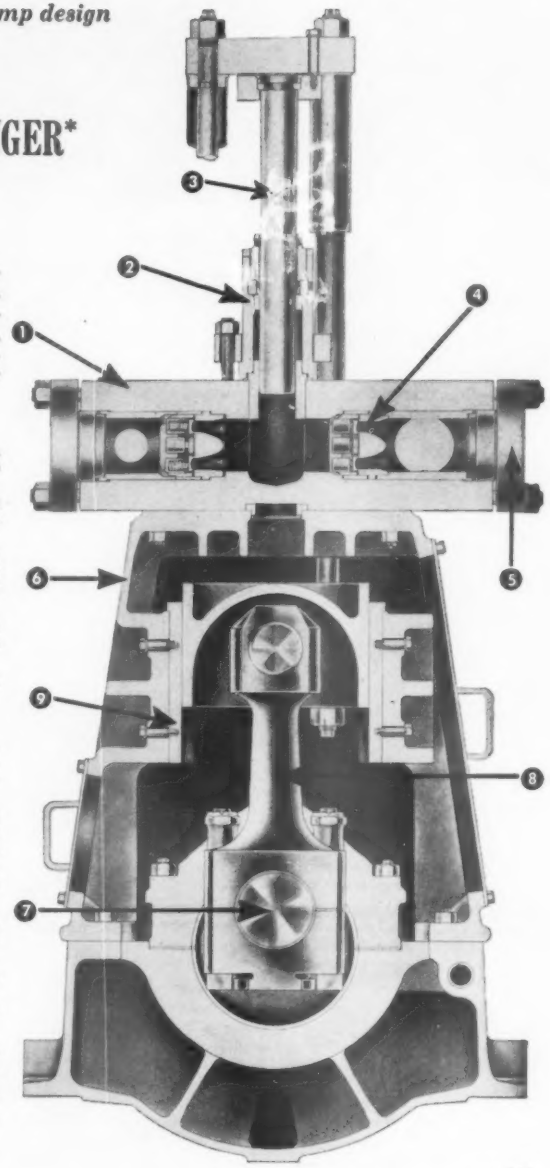
VALVES • FITTINGS • PIPE • PLUMBING • HEATING

The inside story of a new power-pump design

THE WORTHINGTON HEAVY-DUTY MULTI-PLUNGER* VERTICAL POWER PUMP

To users of Worthington pumps, "heavy-duty construction" is almost taken for granted. But when Worthington engineers make a special effort to put *extra* ruggedness into a pump, you have something comparable to this Worthington Multi-Plunger Power Pump. Study the features and see for yourself!



ON THE LIQUID END

1. LIQUID CYLINDER—made of forged steel with large fluid passageways bored from solid forgings for maximum strength.

2. STUFFING BOXES—forged-steel barrels, bolted directly to cylinder with extra-deep boxes that permit maximum interchange of plunger sizes.

3. PLUNGERS—made from hardened and ground alloy steel or any other suitable metal. Solid ceramic plungers can be furnished for corrosive applications.

4. VALVE SERVICE—stainless-steel, heat-treated valves and valve seats. High-strength valve springs and bolted valve-hole covers.

5. INDIVIDUAL VALVE HOLE COVERS—one for each valve, permits quick and easy access.

ON THE POWER END

6. CAST-IRON FRAME—totally enclosed, with design that permits torque to be applied near foundation. All bearing surfaces and running parts pressure lubricated.

7. ONE-PIECE STEEL CRANKSHAFT—one-piece forged steel, accurately turned and ground to size. Heavy sections for minimum shaft deflection when loaded.

8. CONNECTING ROD—marine-type, forged-steel, with steel-backed, babbitt-lined crankpin bearings and solid bronze crosshead pin bearings.

9. CROSSHEAD CRADLE LINERS—solid cast iron with bronze liner shim adjustable to permit careful alignment.

10. BRONZE-SHELL MAIN BEARINGS†—two-piece bronze shell design babbitt-lined with large bearing surface for longest-life. Precision made for trouble free operation.

If your application calls for a power pump of this size, *or any other size*, write, stating specific requirements, to Worthington Corporation, Reciprocating Pump Division, Harrison, New Jersey.

*available in 3, 5 or 7 plunger arrangements (300, 500, 700 hp)
†not shown in drawing

P.2.2

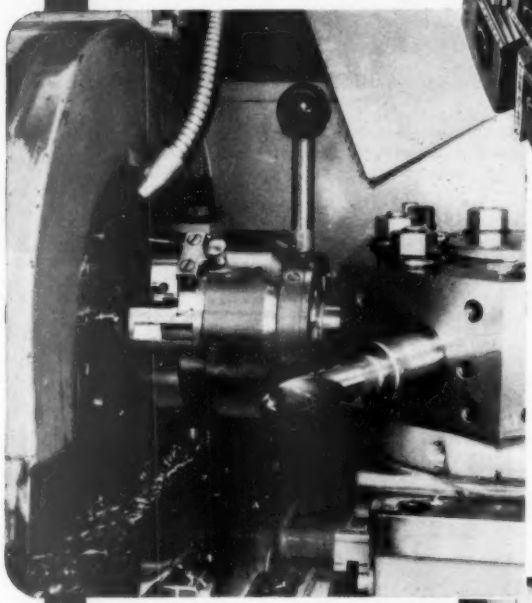
WORTHINGTON
Power Pumps

The World's Broadest Line Assures You the Right Pump for Every Job

1800 Stainless Steel Threads PER CHASER GRIND

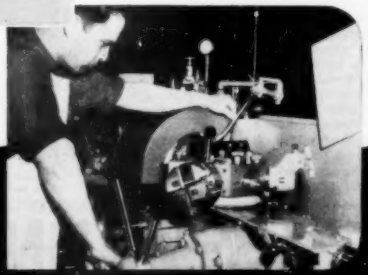
LANDMATIC HEADS are every day saving production dollars for the Crawford Fitting Company of Cleveland by low tool cost and minimum machine downtime.

This company manufactures Swagelok Tube Fittings ranging from ⅛" to 1" in diameter. These fittings are produced from stainless steel tees of austenitic type 316 cold-worked to a Brinell hardness of 250. In producing the 7/16" fitting, for example, (as illustrated) 20-pitch straight UN threads are cut close to the shoulder 5/16" long to Class 3 fit.



LANDMATIC Hardened and Ground Heads, such as used by Crawford, are designed to produce threads to Class 3 or 4 fit in all types of tough materials. Unusually heavy construction and sound fundamental die head design assure the rigidity necessary for accurate threads. The inherent features of the design of the Landis Tangential Chasers and their proper manufacture and hardening, developed during 50 years of threading experience, ensure long chaser life and low threading cost.

If you require threads on stainless steel or other tough material, LANDMATIC Hardened and Ground Heads offer you these same cost-saving features. Please send specifications and write for Bulletin F-80 for additional information.



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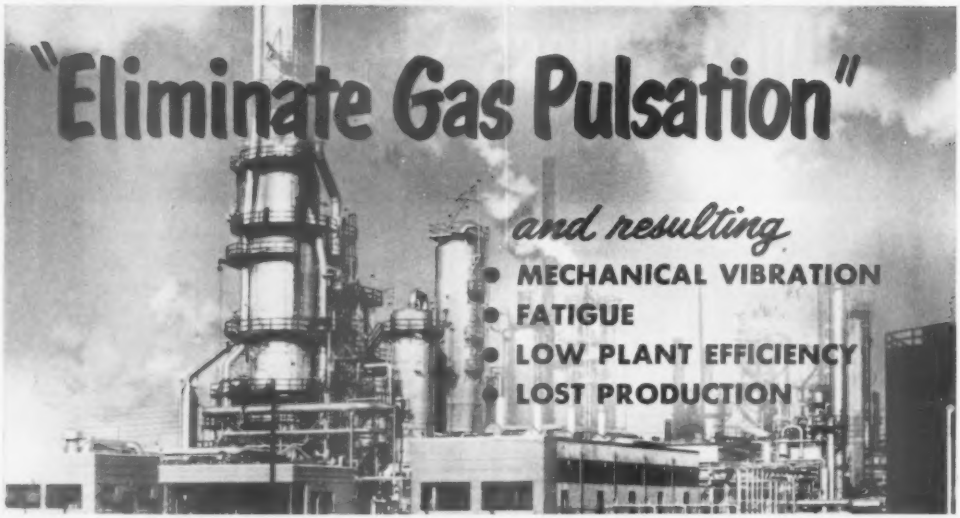
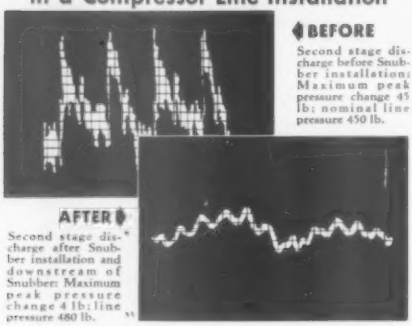


Solution to a typical Surge Problem in a Compressor Line Installation



BEFORE

Second stage discharge before Snubber installation: Maximum peak pressure change 45 lb; nominal line pressure 450 lb.

AFTER

Second stage discharge after Snubber installation and downstream of Snubber: Maximum peak pressure change 4 lb; line pressure 480 lb.

Send for your copy of a typical Burgess-Manning Pulsation Survey and Analysis Report

BURGESS-MANNING PULSATION SURVEY

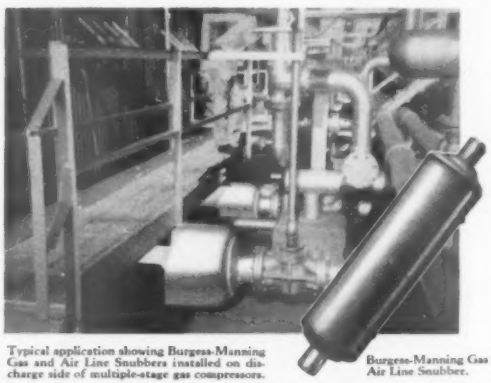
Burgess-Manning pulsation surveys are conducted by trained and fully experienced engineers with electronic equipment including pressure pickup (transducer), amplifier, and oscilloscope. The pressure transducer is coupled as close to the gas stream as possible and faithfully reproduces in voltage the pressure changes in the pipe. This voltage is conducted to a three stage amplifier and then to the oscilloscope screen. Photographs are taken of the screen as a record of surge. Data is taken and recorded. Maximum peak pressure change is calculated. Report is prepared. Recommendations are made that best solve your problems.

CONSULT BURGESS-MANNING ENGINEERS

Gas pulsation in compressor piping systems often results in excessive vibration and material fatigue. This, in turn, necessitates constant maintenance in piping and equipment resulting in lower over-all plant efficiency.

Your compressor system pulsation problem can be solved by Burgess-Manning Company engineers. This division maintains a field service to make surveys and analyses of flow conditions in pressure piping. Trained engineers correlate this data for reference in making Burgess-Manning Gas and Air Line Snubber recommendations for new plants as well as for existing plants.

Write for your copy of a typical case history in which Burgess-Manning engineers solved a tough problem.



Typical application showing Burgess-Manning Gas and Air Line Snubbers installed on discharge side of multiple-stage gas compressors.

Burgess-Manning Gas & Air Line Snubber.

BURGESS-MANNING COMPANY

1203 Dragon Street

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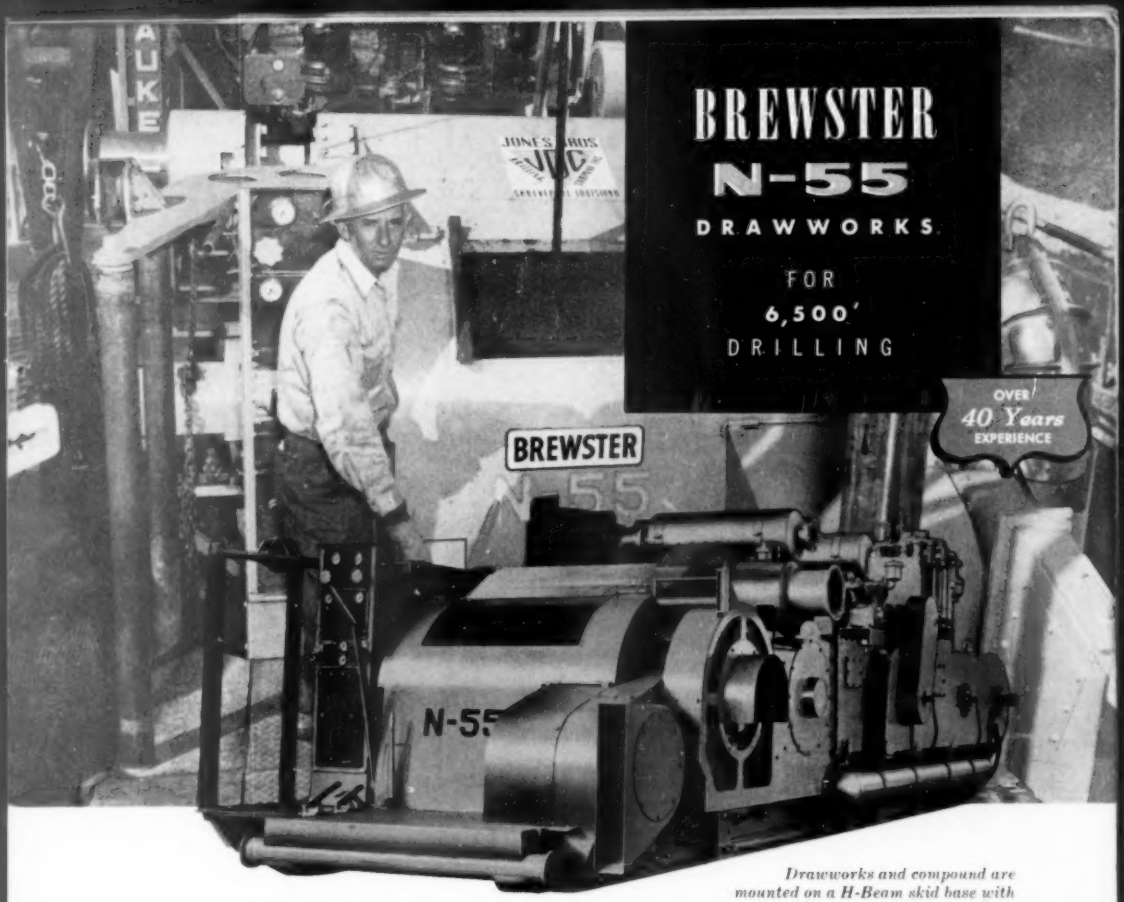


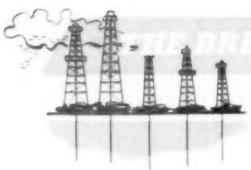
Drawworks and compound are mounted on a H-Beam skid base with provisions for mounting 2 or 3 engines.

A SMALL RIG WITH THE FLEXIBLE POWER OF A BIG RIG — that's what drilling contractors want — that's what Brewster offers them in the N-55. Today, less than two years after its introduction, the N-55 can be found throughout the Southwest, where drilling is around 6500 feet. Its flexible transmission, evenly graduated drum speeds and simple controls make the most economical use of its 500 horsepower. The engineering which has gone into the N-55 is based on Brewster's forty-two years' experience — and the soundness of that design has been proved in thousands of feet of low cost hole.

BIG RIG FEATURES OF THE N-55

500 horsepower transmission — large diameter, extra length drum core—auxiliary positive clutch built into the low drum drive. The only drawworks manufactured for medium drilling which brings you evenly graduated line speeds — 8 forward, 4 reverse, and 4 forward, 2 reverse, rotary speeds.

Let us tell you how the N-55 brings a new economy to medium depth drilling programs.

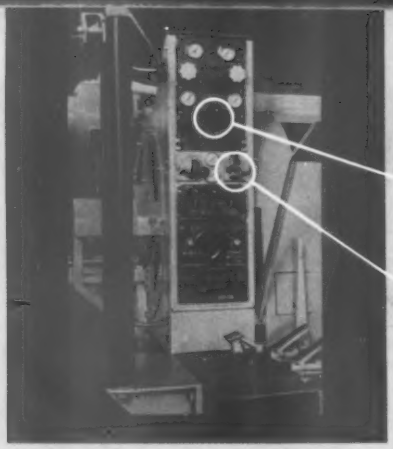


THE BREWSTER COMPANY, INC.
SHREVEPORT, LOUISIANA

BREWSTER DRILLING EQUIPMENT

ASK YOUR NEAREST SUPPLY HOUSE TO TELL YOU ABOUT THE N-55 DRAWWORKS

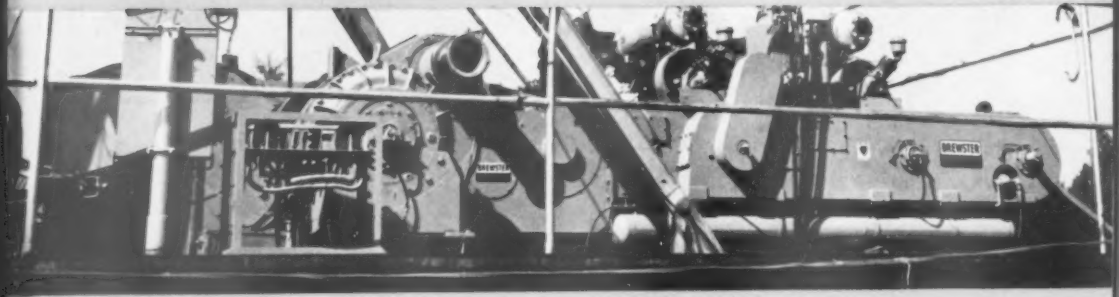
Apex Equipment Company • Murray Brooks, Inc. • Reams Supply Company
Bovaird Supply Company • Industrial Supply Company • In Canada:
Rocky Mountain Supply Company – Direct and through recognized export dealers.



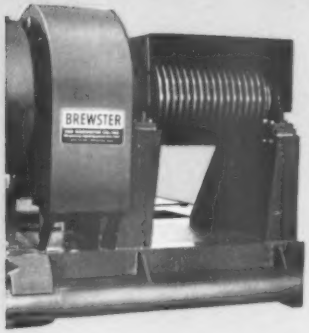
SIMPLE, POSITIVE CONTROLS

TRANSMISSION FRICTION CLUTCH *is controlled by one 4-way valve to give you rapid changes of speed in low and high ranges as well as reverse or full stop. Permits changes when drawworks is in motion and provides safety shutdown in emergency.*

HIGH-LOW DRUM DRIVES, *usually found only on bigger rigs, affords driller 3 to 1 line speed ratio. (This feature is especially desirable for going into hole with drill pipe.)*



Low profile of drawworks and compound gives driller maximum visibility. N-55 compound is same basic design as that of larger Brewster rigs — proven through 15 years of use.



PUMP DRIVES

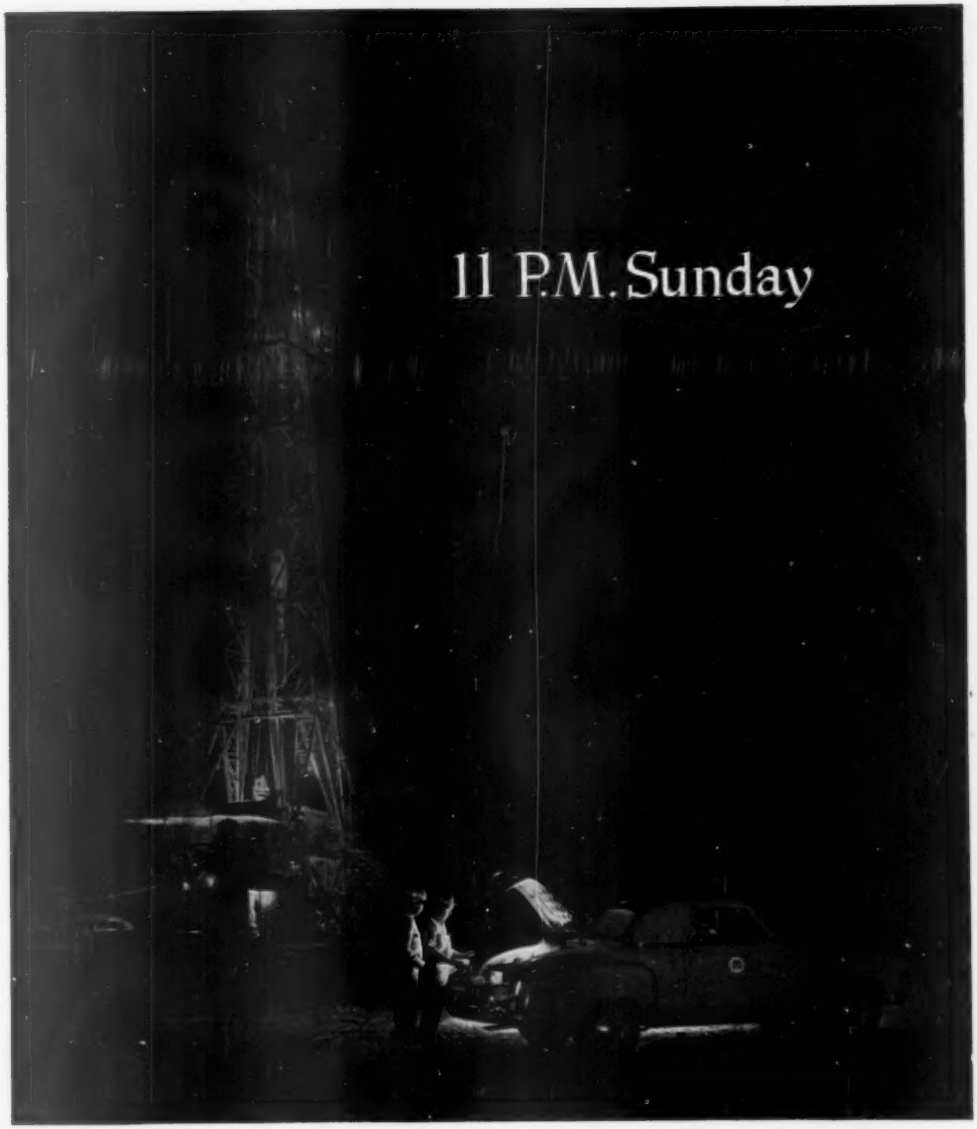
VEE BELT PUMP DRIVE *is same rugged type as used on larger rigs with drive shaft mounted on two pedestal bearings. Gap mounted Fawick air clutch allows shaft to turn only when driving pump.*

THE BREWSTER COMPANY, INC. Shreveport, Louisiana

SPECIFICATIONS

Transmission Speeds	Lineshaft RPM	Rotary Drive Sprocket RPM 177-1½"P	Low Speed Drum Drive Line Speeds and Pulls	High Speed Drum Drive Line Speeds and Pulls
LOW	154	195	288'/Min. 43,000 lbs.	987'/Min. 13,000 lbs.
SECOND	207	263	387'/Min. 33,000 lbs.	1,326'/Min. 10,000 lbs.
THIRD	314	399	588'/Min. 22,000 lbs.	2,090'/Min. 7,000 lbs.
HIGH	422	537	791'/Min. 16,000 lbs.	2,710'/Min. 5,000 lbs.

AUXILIARY EQUIPMENT — *RSH-18 ROTARY • MODEL 4-S OILBATH SWIVEL • H-120 HOOK BLOCK*



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Any hour 'round the clock, any day of the week, in any weather...your Baroid field service engineer will be there where you need him, his specialist's knowledge and experience working for you toward faster, safer, more economical drilling.

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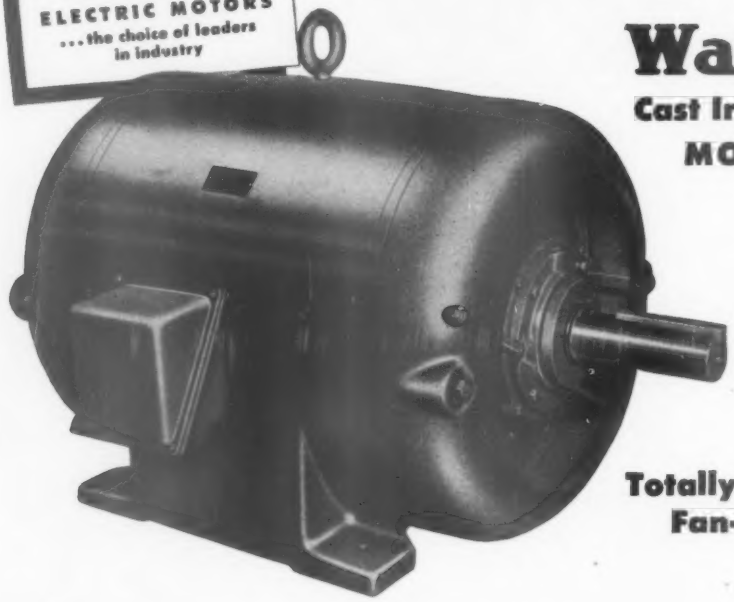
Wagner
ELECTRIC MOTORS
...the choice of leaders in industry



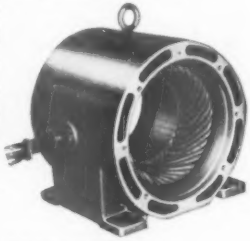
Wagner
Cast Iron Frame
MOTORS

Totally-enclosed
Fan-cooled

Built for use in corrosive atmospheres

Wagner Cast Iron Frame Motors are designed to provide the corrosion resistance demanded by applications in chemical plants or in other applications where protection against corrosion is required. They feature completely protected laminations . . . special varnish treated windings . . . a cast iron, gasket-sealed conduit box . . . a running shaft seal . . . and are totally-enclosed and fan-cooled for complete protection against acids and alkalies present in the atmosphere in the form of dust, fumes or moisture. The photo at right illustrates the rugged, one piece cast iron frame, showing openings for ventilation.

Where additional protection against explosive atmospheres is desired, an explosion-proof design (type JP) is available. Both the standard (type EP) and the explosion-proof types are built in ratings from 2 to 250 hp., with either normal or high torque characteristics. Non-ventilated 1 and 1½ hp. motors also available. Wagner Bulletin MU-132 gives complete information on these corrosion-resistant motors. Write for your copy today.



WAGNER ELECTRIC CORPORATION
6389 Plymouth Ave., St. Louis 14, Mo., U.S.A.

® Wagner Electric Corporation
EST. 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

M52-16

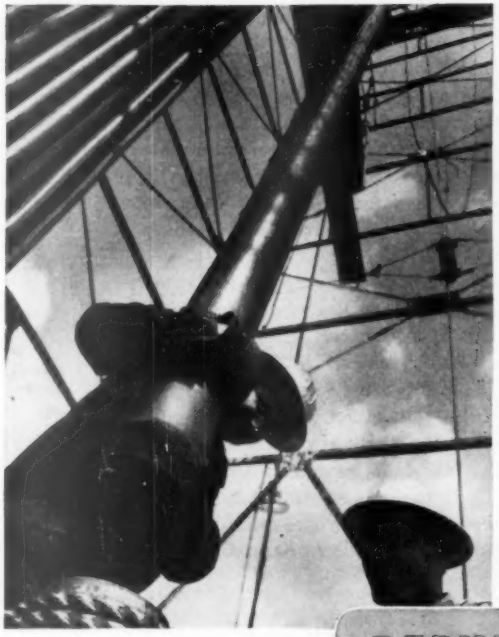
How to keep threads in top condition

Reminders of Good Casing Practices:

Do not remove protector from field end of casing until ready to stab. Apply thread compound over the entire surface of the threads just before stabbing. The brush or utensil used in applying thread compound should be kept free of foreign matter and the compound should never be thinned.

—Reprinted by permission from "API Recommended Practice RP5C1: Care and Use of Casing, Drill Pipe and Tubing."

REPUBLIC *Electric Weld* CASING and TUBING



- **Make up fast**
- **Resist pull-out**
- **Resist collapse**

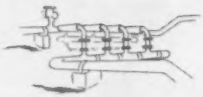
. . . because they're uniformly round, uniform in wall thickness and diameter, uniformly strong and sound. These Electric Weld tubular products are cold-formed from high ductility steel—and fully normalized for uniform structure. Casing is cold sized to further increase its high yield strength. Clean, full-formed threads stab, spin-in and tong-up fast—and tight. A uniform depth of tough steel beneath thread roots all around the pipe guards against pull-outs. Write for descriptive literature.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N.Y.

REPUBLIC *Electric Weld* STEEL
NORMALIZED CASING AND TUBING

Other Republic Products include Line Pipe—Carbon, Alloy and Stainless Steels—Upset Studs, Bolts and Nuts—Electrunite Heat Exchanger Tubes

at the wells . . .

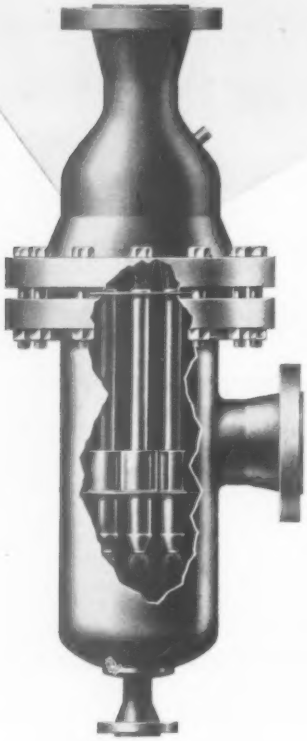


in the pipelines . . .

DRY GAS SCRUBBERS

assure you efficient natural gas cleaning

without liquid filters



Aerotec Dry Gas Scrubbers offer you a highly efficient means of removing dusts and distillates from gas. In the "Big Inch" and many other installations at wells and in pipelines, these units are daily proving the advantages of *dry* scrubbing.

The Aerotec Gas Scrubber uses no oil or other liquid as a filtering medium. This eliminates carryover and other normal disadvantages of conventional type scrubbers. By keeping the gas clean and dry, Aerotec units help prolong the life of compressors and reduce pipeline maintenance.

Aerotec precipitating tubes are the heart of this dry scrubber. Gas passes through these multiple, small-diameter tubes, and the foreign matter is separated from the gas by centrifugal force. Discharge is continuous.

Space-saving compactness, light weight, and piping simplicity of the Aerotec Dry Gas Scrubber permit easy installation. The standard units are available in practically any size up to 100,000,000 SCFD. Manifolding meets needs for larger capacities. Our representative will gladly recommend the Aerotec Scrubbers your specific gas-cleaning problem requires. Call or write today.

Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.

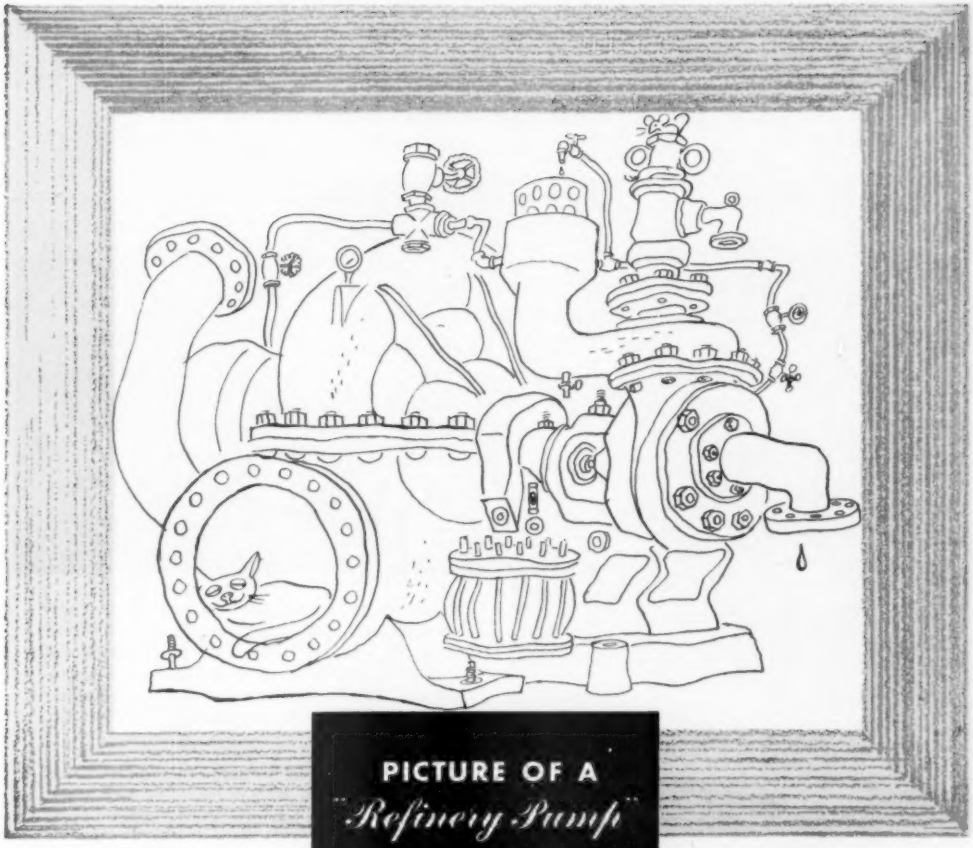
(Offices in 38 Principal Cities)

Canadian Affiliates: **T. C. CHOWN, Ltd., Montreal 25, Quebec; Toronto 3, Ontario**

Manufacturers

THE AEROTEC CORPORATION

GREENWICH, CONN.



PICTURE OF A "*Refinery Pump*"

"Refinery" pump? There ain't no such animal. But if one pump could be all things to all processes, it *might* look like this. Fact is, however, that in refining *it's pretty important to have each pump fitted to its specialized job.* No *one* answer is good for all.

That's why Byron Jackson builds job-engineered pumps. With a BJ you're sure of a pump that sizes up to the need and is pin-point engineered to profitable performance. Starting with more than 25 basic BJ pump designs used in the refinery field, BJ engineers can incorporate features to meet particular pressure, temperature, corrosive, material or power requirements.

When you need a pump for your refinery operation — check with BJ first!

Byron Jackson Co.

Since 1872

P. O. Box 2017 Terminal Annex, Los Angeles 54, Calif.

OFFICES IN PRINCIPAL CITIES

SEE **BJ** FOR THE **ENGINEERED** ANSWER TO YOUR PUMPING PROBLEMS

GRAVER CENTER-WEIGHTED FLOATING ROOF TANKS
FOR NEW PLATTE PIPE LINE

Guernsey, Wyoming:
two Graver 100' x 40'
Center-Weighted Floating Roof Tanks.

Salisbury, Missouri:
four Graver 134' x 48'
Center-Weighted Floating Roof Tanks.

To provide for corrosion-resistant storage of crudes along its 1056-mile course from Wyoming to Wood River, Ill., the new Platte Pipe Line uses Graver Center-Weighted Floating Roof Tanks at its Guernsey and Gurley injection stations and at its Salisbury pumping station — a total capacity of more than 300,000 barrels.

This new 20-inch line, designed to transport 110,000 b/d from Rocky Mt. fields to refineries, must handle 25 different crudes. Graver's Center-Weighted Floating Roof design — with its inward sloping deck in full contact with the stored crude — assures both the absence of corrosion and the retention of volatile hydrocarbons, since no space exists beneath the single deck for air and vapor to combine and induce corrosion.

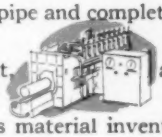
GRAVER

Gurley, Nebraska:
one of four Graver 100' x 40'
Center-Weighted Floating Roof Tanks.

GRAVER TANK & MFG. CO. INC.
EAST CHICAGO, INDIANA
NEW YORK • CHICAGO • PHILADELPHIA • WASHINGTON
DETROIT • CLEVELAND • PITTSBURGH • HOUSTON
CATASAUQUA, PA. • SAND SPRINGS, OKLA. • CASPER, WYO.

Your WATCHDOG COMMITTEE on COSTS will approve

SHOP FABRICATION OF PIPING

because . . . both quality and economy are guaranteed. Piping is fabricated in Grinnell shops under ideal conditions, with modern equipment, by personnel qualified in all classes of work. Price (determined in advance) includes competent engineering, scheduling and shop sketches, efficient material procurement. Grinnell supplies heat, light, power, water, compressed air, expendable tools and supplies. Grinnell shops have large storage areas for pipe and completed assemblies, expensive modern equipment,  a permanent staff of skilled workers. Grinnell finances material inventories and payrolls; carries insurance. The customer pays for no waste material or spoilage. Shop fabricated piping is rigidly inspected and tested to meet exacting requirements of customer's specifications and applicable codes. It is cleaned inside and outside and painted. Squared to standard dimensional tolerances, sub-assemblies are erected at the job site more quickly and easily. It all adds up to this . . . shop fabrication by Grinnell guarantees quality and economy.

Write for complete facts.

GRINNELL

WHENEVER PIPING IS INVOLVED

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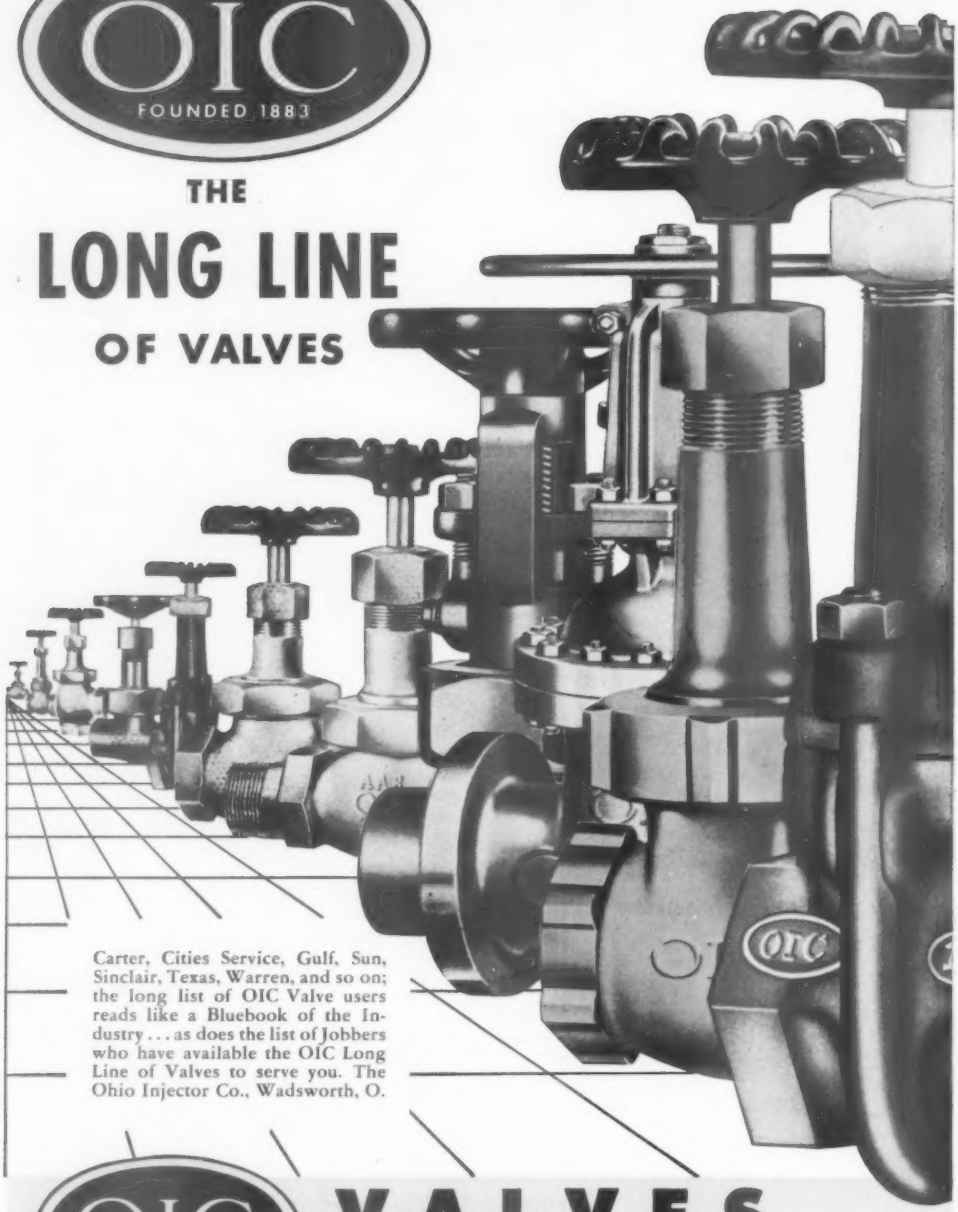
pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves • Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies • industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

OIC
FOUNDED 1883

THE
LONG LINE
OF VALVES



Carter, Cities Service, Gulf, Sun, Sinclair, Texas, Warren, and so on; the long list of OIC Valve users reads like a Bluebook of the Industry . . . as does the list of Jobbers who have available the OIC Long Line of Valves to serve you. The Ohio Injector Co., Wadsworth, O.

OIC
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VALVES
FORGED AND CAST STEEL · IRON · BRONZE

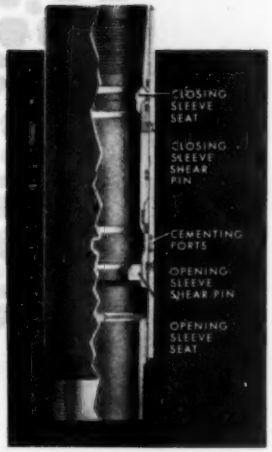
SAVE STEEL

SAVE CEMENT

SAVE TIME

SAVE MONEY

GET MULTIPLE SAVINGS



with HALLIBURTON'S DV ★ MULTIPLE STAGE CEMENTER

SAVE STEEL, CEMENT, TIME and MONEY

time and time again. Take advantage of one of the most versatile tools in the industry. With Halliburton's *exclusive differential valve* you can accomplish any number of money saving operations with complete peace of mind.

You can two stage or three stage and save strings of casing. You can isolate shallower zones without running a continuous column of cement. You can prevent deep formation breakdown by letting the lower stage set before multiple staging upper zones of the cement column . . .

Differential Valve Makes the Difference! . . . Halliburton's exclusive DV – differential valve – incorporates an important principle of hydraulics. Two sleeves are housed within the tool body. The lower, or opening sleeve, seals tool ports during circulation and passage of cement for the lower stage. The upper, or closing sleeve, seals off the tool ports after completion of the upper stage. Each tool has four cement ports.

Precision built, the Halliburton DV today is delivering safe application in thousands of wells regardless of depth, pressure, or temperature. It assures you of a positive fluid shutoff and strength to withstand any pressure up to the collapsible strength of the casing. A special arrangement of opening and closing plugs and tool sleeves gives you three stage cementing with utmost simplicity and economy.

Look into this money saving DV Cementer right away. Your nearby Halliburton representative will go over its exclusive engineering advantages at your convenience. Or write Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

HALLIBURTON

YEARS AHEAD IN ADVANCED CEMENTING TECHNIQUES!

Handling the turnaround problem on petroleum processing units is just one of the many services offered by Procon to the petroleum and petrochemical industries. Procon's work includes not only the construction of major processing facilities but office buildings, electrical installations, sewers, roadways, and utilities.

Procon's **demonstrated** ability to handle any job—large or small —and see it through from ground-breaking to on-stream is proof of the company's flexibility. And concentration of this flexibility in a specific field provides the specialized knowledge and experience that are required in today's operations.

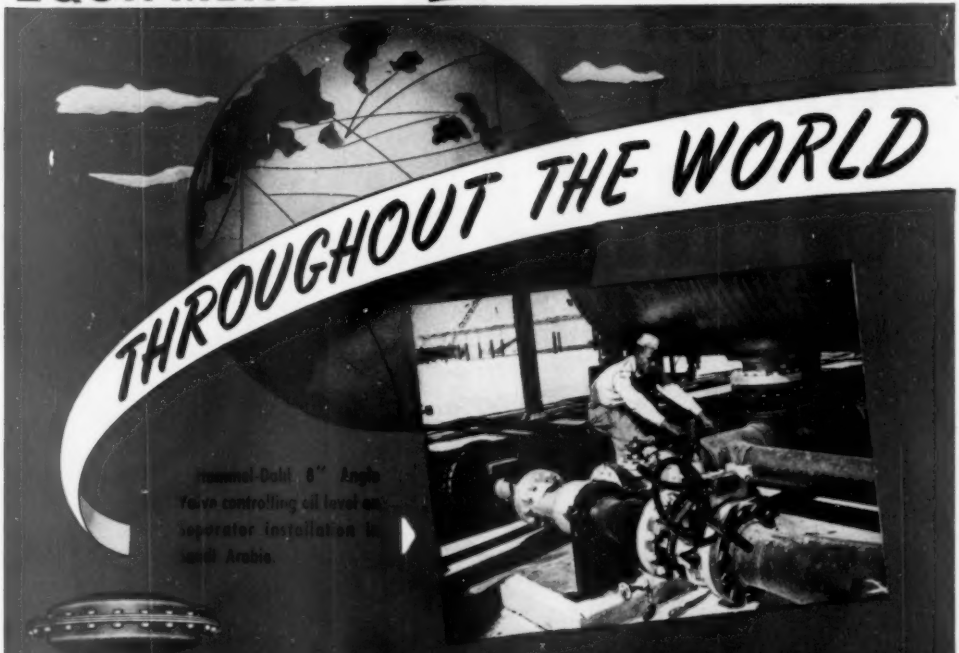
The advantages of this effective combination are reflected in the efficiency and economy with which Procon has handled its projects and in the number of jobs it has been awarded during the past two years.

PROCON *Incorporated*

PROCESS CONSTRUCTION
1111 MT. PROSPECT ROAD, DES PLAINES, ILL., U.S.A.

AUTOMATIC CONTROL EQUIPMENT

HAMMEL-DAHL



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easy on
easy off
with OIL

the easy
bearing mounting
and removal system

pioneered by SKF

SKF®

BALL AND ROLLER BEARINGS

No designer today has to be sold on the advantages of anti-friction bearings. However they *used* to pose one serious problem to machine designers — that of the difficulty of mounting and removing interference fits, especially in bearings of comparatively large size. *Not so today.*

In the System of Hydraulic Removal, developed by SKF, OIL does the work. With simple equipment, you force oil between the shaft and the bearing, pressure breaks the fit, and the bearing slides off quickly, easily, safe from damage to bearing or housing. The same system eliminates the need for driving the tapered bore bearing *on* the shaft, or heating to obtain a shrink fit.

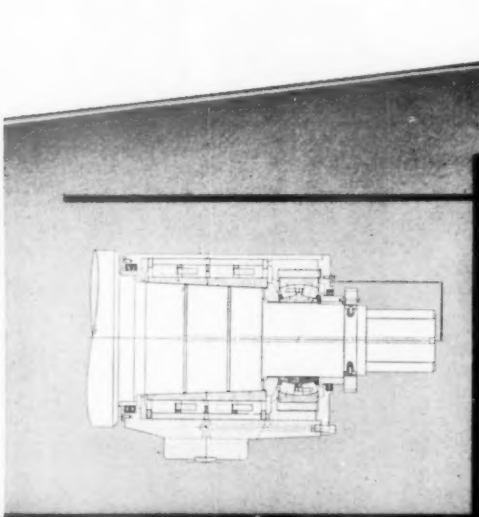
The accompanying illustrations show a few of the successful applications of this SKF principle —on roll neck bearings in steel mills, printing cylinder and paper mill roll bearings, on "OK" Shaft Couplings, main and crank pin bearings in air compressors. The principle is also well suited to other equipment such as crushers, construction machinery, etc.

SKF's first patent application on the hydraulic mounting principle was made in 1943.

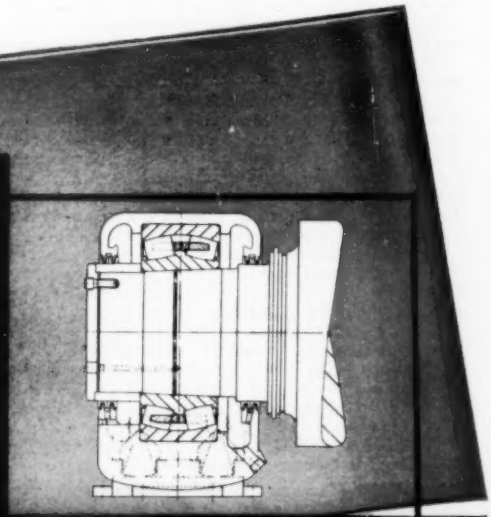
Since then, more and more equipment designers are taking advantage of this SKF "first." For further details, write for SKF Brochure No. 344.

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA. —*manufacturers of* **SKF** *and* HESS-BRIGHT *bearings.*

7351

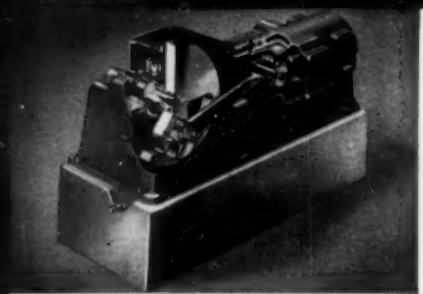


Typical Application Of **SKF** Hydraulic Mounting For Roll Neck Bearing.



Typical Application Of **SKF** Hydraulic Mounting For Printing Cylinder And Paper Machine Roll Bearing.

"OK" Coupling On 7 3/8" Marine Shaft, Depends On Pressure Only To Transmit Torque. Separable By **SKF** Hydraulic System.



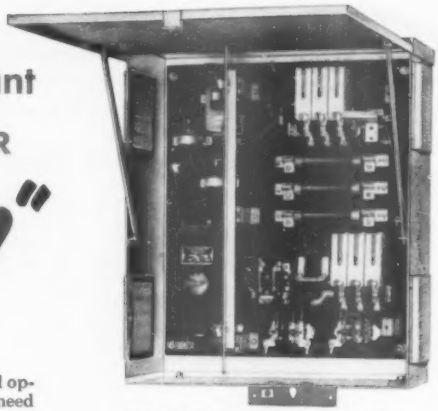
SKF Roller Main And Crank Pin Bearings With Hydraulic Mounting Feature On A Pneumatic Compressor.

We give you what you want

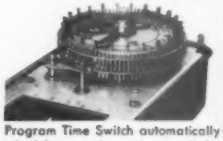
in genuine CUTLER-HAMMER

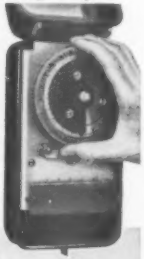
"Oil Country"

well pumping control



C-H 9589 oil well pumping controller with 3 coil overload and undervoltage relay.





Program Time Switch automatically schedules pumping, set up easily by pull tabs—one for each 15 minute interval. Day omission feature also available, for non-operation any selected days of week.

Cutler-Hammer went to the oil country to find out what oil operators, practical production men, maintenance crews really need and want in their oil well pumping control.

And Cutler-Hammer Oil Country Control *proves out.* The practical way in which heat is shielded out and fresh clean air pours in around the working mechanism proves out. You never see C-H control with the door propped open to keep it working.

The extraordinary care to keep out dirt, large particles of dust and bugs proves out. Louvres, bronze-screening and baffle plates do their work. And the famous C-H Vertical dust safe contacts shed dirt and dust to keep clean, sure contacts. Timer is neoprene-gasketed and dust proof. And the excess torque time clock keeps going if inadvertently dust gets in.

Undervoltage relay if you want manual restarting. Automatic time delay if you want automatic staggered starting of groups of motors. Two coil overload if that is adequate—but three coil overload is available where single phasing occurs often.

Pumping sequence changes are made in 15 minute increments. You just pull small, accessible tabs. Day omission feature is also available on the time programming switch when your scheduling calls for skip-a-day pumping.

Unit type lightning arresters that tell at a glance if they've blown and eliminate the need to clean up or rebuild the starters.

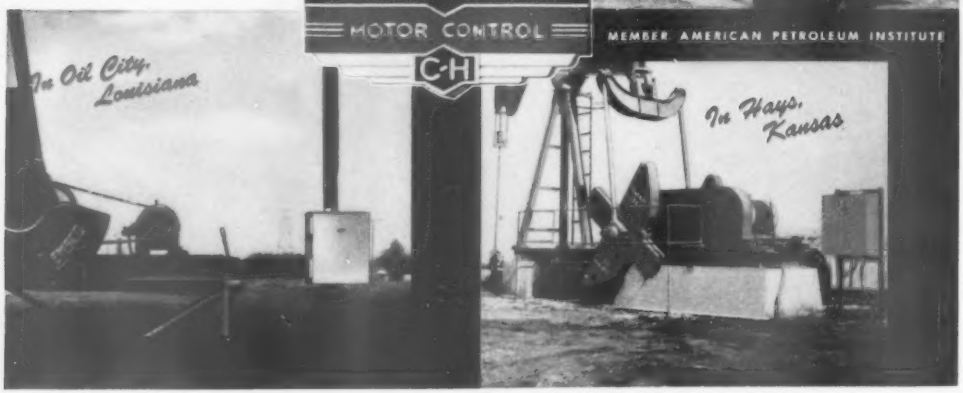
There are so many wanted features on these controllers, there is not room enough to tell them all. Ask for further information. Or better still, try out a C-H starter and compare it with the performance of any other make you have ever had. CUTLER-HAMMER, Inc., 1453 St. Paul Avenue, Milwaukee 1, Wisconsin. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto.

CUTLER-HAMMER

MOTOR CONTROL

C-H

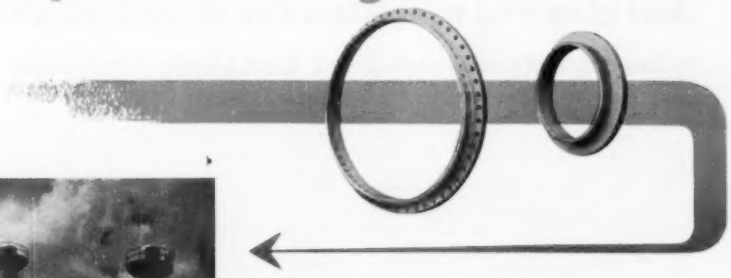
MEMBER AMERICAN PETROLEUM INSTITUTE

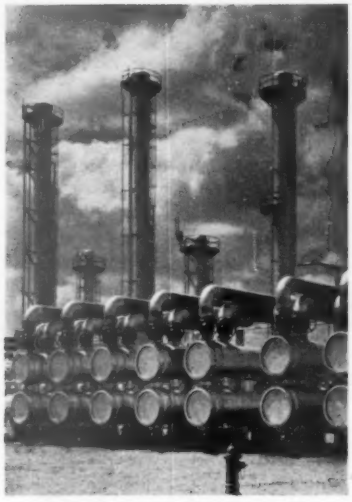


for better connections—

Specify

Railway Steel Flanges





The flanges on your heat exchangers, pressure vessels and piping are among the most important safeguards your products have. Using top quality Railway Steel flanges assures you top performance in every application.

Alloy and carbon Railway Steel flanges are made from start to finish by our metallurgists and craftsmen. The steel is produced in our own furnaces. Complete and rigid control is maintained over every stage of fabrication—forging, rolling, heat treating, machining. Railway Steel flanges are made in a wide range of sizes and sections from 18 in. ID to 150 in. OD . . . all standard types, plus special types including flanges to meet TEMA specifications.

See our sales representative in New York, Richmond, Cleveland, Chicago, St. Louis, St. Paul or San Francisco for full information about Railway Steel flanges.

Railway also fabricates weldless rings for use as brake rims, gear blanks and circular forgings of many types. All are forged of our own steels assuring top performance, complete dependability, long life.

Railway Steel Flanges

RAILWAY STEEL-SPRING DIVISION

AMERICAN LOCOMOTIVE COMPANY

SAFE STRAIGHT-

. . . assured with Warner Electric Brakes that give you precision synchronization plus two independent braking systems

With Warner Electric Brakes on your trailers your drivers have a *double safety factor!*

First—the independent Warner *electric* trailer brake system synchronizes *instantly* with tractor brakes for perfectly balanced braking of the entire unit. There is no time-lag in the action at any point.

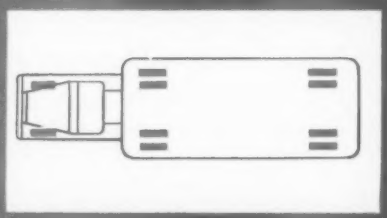
Trailer braking is operated electrically, *with lightning speed,* to apply in the exact degree of power wanted. And in *exact unison* with the tractor brakes!

This precisely synchronized Warner *electric* action means smooth *straight-line* deceleration and stops. Tractor and trailer act as a *single unit* to guard against skidding, sliding, jack-knifing.

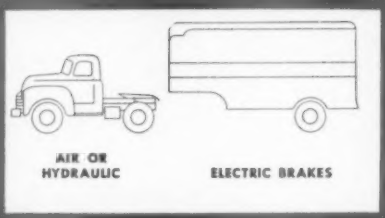
And second—Warner electric trailer brakes give you *two* independent braking systems. If one should become inoperative for some reason, you still have control. As stated by "Sarg" Stava, equipment manager, Houston Farm of B. F. Walker, Inc., (shown right): "The driver gets a two-for-one chance to stop."

Give your drivers the advantages made possible with *completely balanced braking* of *two independent braking systems.* Investigate Warner Electric Brakes now—for double safety, double dependability to match any road or load condition!

WARNER ELECTRIC BRAKE & CLUTCH COMPANY, BELOIT, WISCONSIN

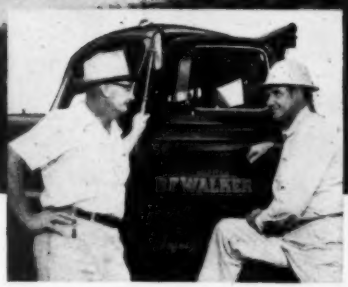


PRECISE SYNCHRONIZATION FOR BALANCED BRAKING. Warner Electric Brakes make it possible to positively synchronize all brakes. No matter how far the rear trailer wheels are from the driver's brake pedal, braking power is applied *instantly*. All brakes on tractor and trailer respond uniformly. Result—safe, *straight-line* braking!



TWO INDEPENDENT SYSTEMS FOR DUAL SAFETY. By using air or hydraulic brakes on your tractor and Warner Electric Brakes on your trailer, you have a dual safety factor. With two braking systems, the driver is assured that if one system fails, the other will bring the vehicle to a safe, sure stop.

-LINE BRAKING



B. F. Walker, Inc. standardizes on Warner Electric Brakes for all over-the-road trailers

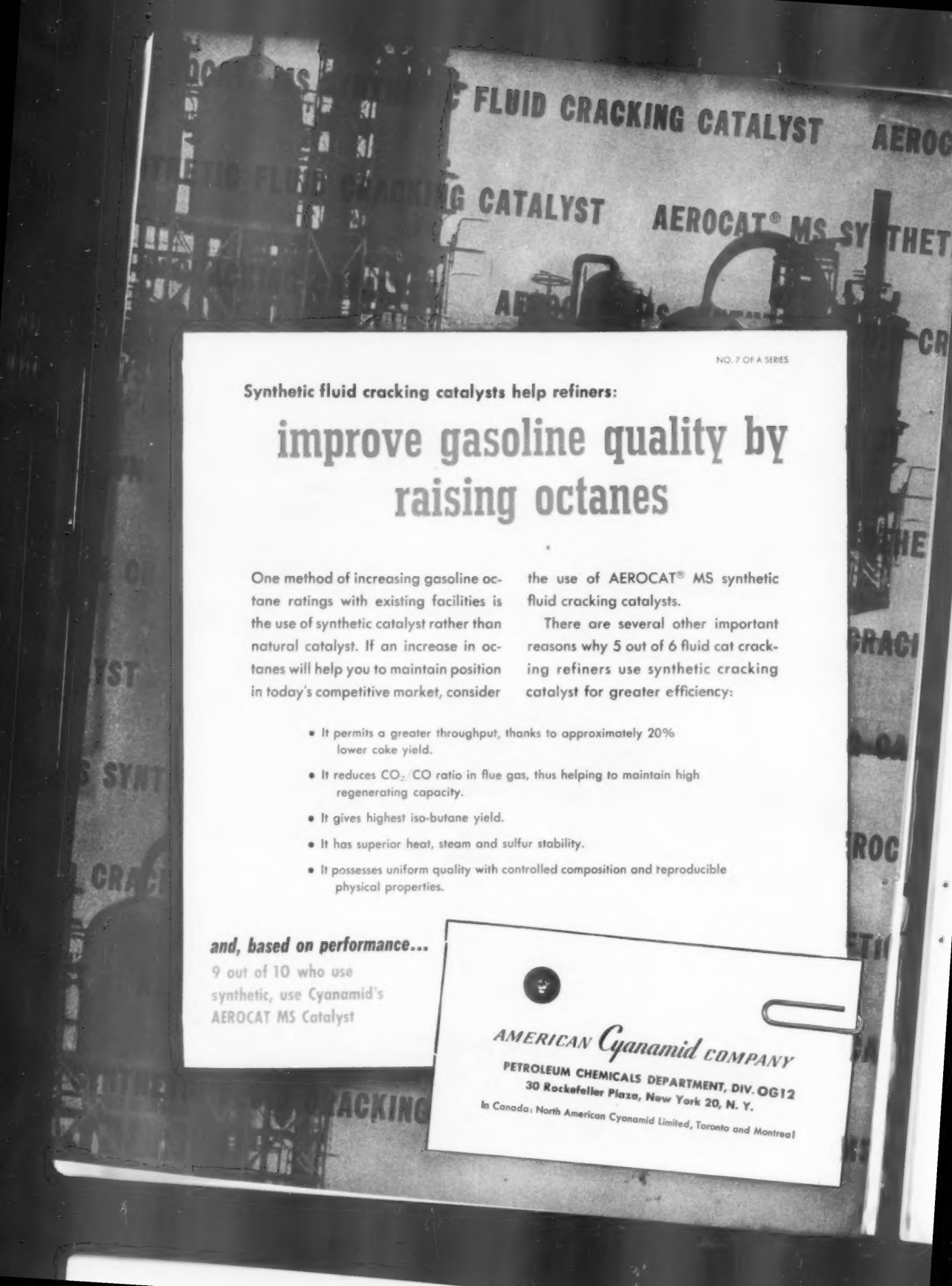
Hauling oil-field materials throughout five states, Warner-equipped trailers of B. F. Walker, Inc., Houston, Texas, average 500 to 800 miles per trip over all types of roads in all kinds of weather.

Brakes get a real test in this kind of operation and here's why the company standardizes on Warner: "Less trouble, less margin for human error. No leaks or long hoses, no breaks in hose connections for coupling out. More life with less maintenance . . and maintenance is much less expensive."

FREE NEW FACTUAL FOLDER. "Six Steps to Better Braking for Truck Trailers." Gives tips on driver safety through synchronized braking. Explains the many advantages of *electric* braking. Write today. Warner Electric Brake & Clutch Company, Dept. OGJ, Beloit, Wisconsin.

WARNER

ELECTRIC BRAKES
FOR TRUCK TRAILERS



NO. 7 OF A SERIES

Synthetic fluid cracking catalysts help refiners:

improve gasoline quality by raising octanes

One method of increasing gasoline octane ratings with existing facilities is the use of synthetic catalyst rather than natural catalyst. If an increase in octanes will help you to maintain position in today's competitive market, consider the use of AEROCAT® MS synthetic fluid cracking catalysts.

There are several other important reasons why 5 out of 6 fluid cat cracking refiners use synthetic cracking catalyst for greater efficiency:

- It permits a greater throughput, thanks to approximately 20% lower coke yield.
- It reduces CO_2/CO ratio in flue gas, thus helping to maintain high regenerating capacity.
- It gives highest iso-butane yield.
- It has superior heat, steam and sulfur stability.
- It possesses uniform quality with controlled composition and reproducible physical properties.

and, based on performance...

9 out of 10 who use synthetic, use Cyanamid's AEROCAT MS Catalyst

AMERICAN Cyanamid COMPANY

PETROLEUM CHEMICALS DEPARTMENT, DIV. OG12
30 Rockefeller Plaza, New York 20, N. Y.

In Canada: North American Cyanamid Limited, Toronto and Montreal

an ACCO product

RUGGED...

● That's the best way to describe R-P&C Bar Stock Valves. These fine throttling valves provide precise, positive flow control. Long, low-cost, trouble-free service makes them ideal for meter, gauge, test, and general purpose use. Precision turned . . . from carefully tested metals . . . and suitable for a wide range of pressures and temperatures.

See your R-P&C distributor or write the nearest R-P&C district office for information.

No. **1050** R-P & C Stainless Steel Bar Stock Valve

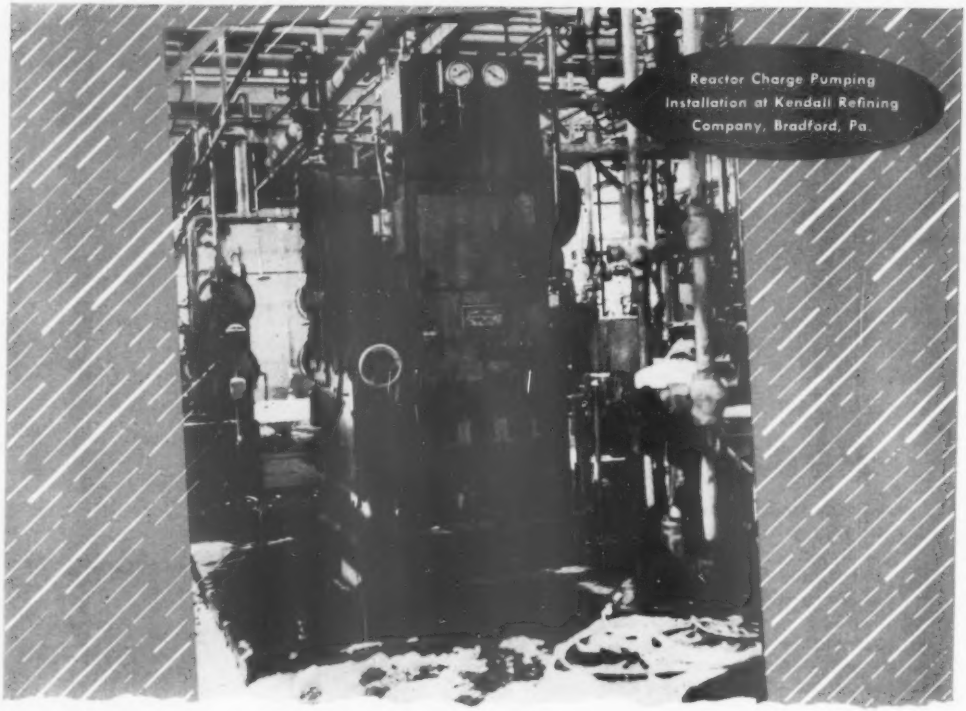
R-P&C valves

ACCO

R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.



ALDRICH-GROFF VARIABLE-STROKE TRIPLEX PUMP *charges 250 F. dependanizer bottoms into reactors of U.O.P. Platformer Unit*

Severe weather conditions do not affect the performance of the Aldrich-Groff Controllable Capacity "Powr-Savr" Pump, specially designed for economical outside installations. Unit illustrated has a capacity of 0 to 2,472-B/D and has been in operation for 21 months.

The Aldrich-Groff Pump automatically controls charging rate in stepless straight-line fashion without change of driver speed. Power consumption is in almost direct proportion to delivery rate. This pump features compact vertical design, with self-contained reduction gear drive for adaption to high speed motor or turbine, mounted high on the pump frame and safe from normal flood conditions. It affords high pumping efficiency with minimum power cost and negligible maintenance expense. It is a "must" where close process control and service reliability are important factors.

Over 500 Aldrich-Groff Pumps, many with service records of over twelve years, are successfully serving varied industries today. Units are built in 0-2″ through 0-6″ stroke sizes, ranging from 5 to 125 H.P. Contact your nearest Aldrich representative for information—or write us direct for Data Sheet 65A.

THE ALDRICH PUMP COMPANY

...Originators of the Direct Flow Pump

9 GORDON STREET • ALLENTOWN, PENNSYLVANIA

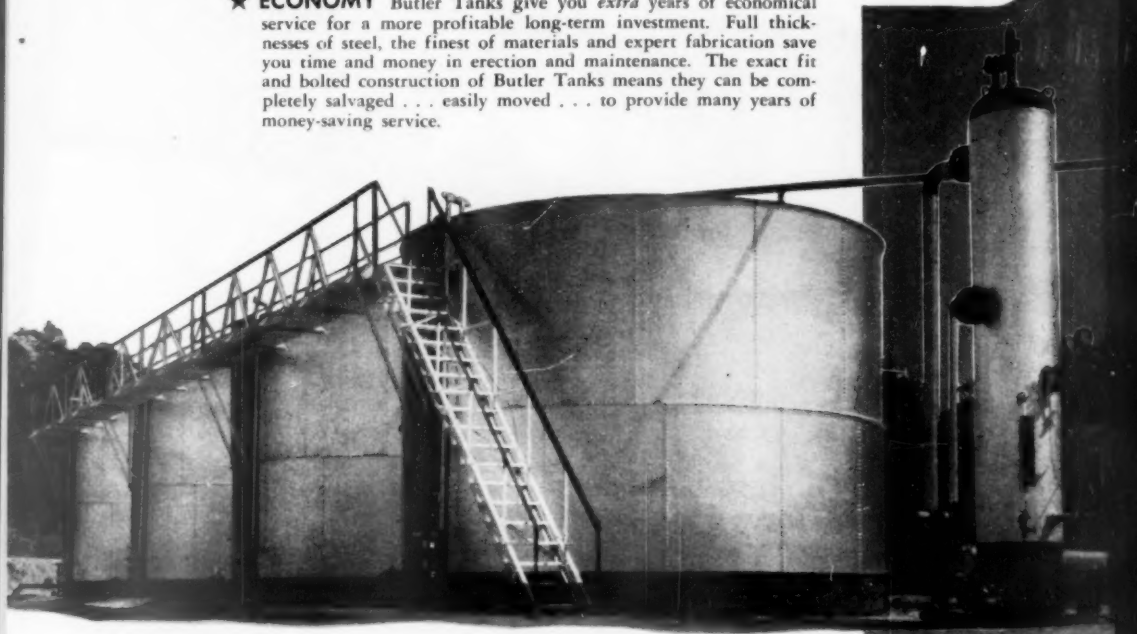
Representatives: P. H. Arden, P. O. Box 185, Glenview, Ill. • Bushnell Controls & Equipment Co., 3929 W. Jefferson Blvd., Los Angeles 16, Calif. • L. T. Gibbs, 509 Petroleum Bldg., Tulsa 3, Okla. • R. B. Moore Supply Co., Inc., Bolivar, N. Y. • Power Specialty Co., 2000 Kipling St., Houston 6, Texas • Reeves & Skinner Machinery Co., 2211 Olive St., St. Louis 3, Mo. Stearns-Roger Manufacturing Co., 1720 California St., Denver 2, Colo. • Export Sales: Petroleum Machinery Corp., 30 Rockefeller Plaza, New York 20, N. Y. • Birmingham • Boston Buffalo • Cincinnati • Cleveland • Detroit • Duluth • Jacksonville • Omaha • Philadelphia • Pittsburgh • Portland, Ore. • Richmond, Va. • San Francisco • Seattle • Spokane, Wash. • Syracuse

Get All 3 with BUTLER BOLTED STEEL OIL TANKS

★ **VERSATILITY** Your oil or refined petroleum products will be safely and economically stored in Butler Tanks. All tanks regularly supplied in your choice of two-coat, aluminum-finish coating or galvanized by the hot dip process. Aluminum decks are available for special applications. Capacities 100 to 10,000 barrels.

★ **DEPENDABILITY** Butler Tanks are built to API specifications. All parts are precision-formed to assure oil-tight construction . . . fast easy erection. Butler's half-century of experience in tank engineering and fabrication is your assurance that Butler Bolted Steel Oil Tanks are dependable.

★ **ECONOMY** Butler Tanks give you *extra* years of economical service for a more profitable long-term investment. Full thicknesses of steel, the finest of materials and expert fabrication save you time and money in erection and maintenance. The exact fit and bolted construction of Butler Tanks means they can be completely salvaged . . . easily moved . . . to provide many years of money-saving service.



You'll always get reliable service from your BUTLER distributor . . .

Your Butler distributor is ready to give you dependable, prompt service on Butler Bolted Steel Tanks, Walkways and Stairways, Loading Racks and other oil field equipment. To serve the immediate needs of any oil operation, Butler distributors maintain complete field service, including planning, erection, cutting down and re-erecting. Whatever your storage requirements, your Butler distributor will serve you better.

- **AMERICAN PIPE & SUPPLY CO.**
  Casper, Wyoming
  Denver, Colorado
  Cut Bank, Montana
- **HARRY G. MILLER**
  El Dorado, Arkansas
- **UNION TANK & SUPPLY CO.**
  Great Bend, Kansas
  Tulsa, Oklahoma
  Oklahoma City, Oklahoma
  Hobbs, New Mexico
  Fort Worth, Texas
  Houston, Texas
  Odessa, Texas
  Snyder, Texas
  Alice, Texas
  Tyler, Texas
  Midland, Texas
  Nocona, Texas
  Abilene, Texas
  LaFayette, Louisiana
  Ruston, Louisiana
  New Orleans, Louisiana
  Casper, Wyoming
  Powell, Wyoming
  Glendive, Montana
  Sterling, Colorado
  Denver, Colorado

KANSAS CITY, MO.
Birmingham, Ala. — Richmond, Calif.
Galesburg, Ill. — Minneapolis, Minn.

BUTLER
STEEL PRODUCTS

OIL EQUIPMENT — STEEL BUILDINGS
FARM EQUIPMENT — CLEANERS EQUIPMENT
SPECIAL PRODUCTS

Contact your Butler distributor today or write

BUTLER MANUFACTURING COMPANY

7464 E. 13th St., Kansas City 26, Missouri
964 6th Ave., S.E., Minneapolis 14, Minnesota
Dept. 64, Richmond, California

Oklahoma City, Okla.

Dear Boss:

You wanted to know how Lufkin Pumping Units have performed in Oklahoma. Here are a few examples from the Oklahoma City Field:

	Well "A"	Well "B"		Well "C"	
		"A"	"B"	"C"	
Well Number:		Sept., 1935	March, 1936	Dec. 1935	
Date Unit Installed:		136,500	132,300	134,400	
Hours Operated, Total:		1,108,719	1,009,414	987,280	
Fluid Pumped (Bbls.):		6,500	6,500	6,500	
Well Depth, in ft.		$18.20	$38.60	$41.10	
Yearly Repair Cost:					

Although these three records are remarkable, there are hundreds of Lufkin Units in Oklahoma with equal, or better, records.

Cordially Yours,
Cooper

LUFKIN FOUNDRY & MACHINE COMPANY

LUFKIN, TEXAS

Branch sales and service Houston, Dallas, New York, Tulsa, Los Angeles, Seminole, Oklahoma City, Corpus Christi, Odessa, Kilgore, Wichita Falls, Casper, Wyoming, Great Bend, Kansas.
Lufkin Equipment in CANADA is handled by
THE LUFKIN MACHINE CO., LTD. 14321 108th Avenue, Edmonton, Alberta, Canada.

LUFKIN IS CELEBRATING ITS 50TH ANNIVERSARY THIS YEAR

LUFKIN PUMPING UNITS

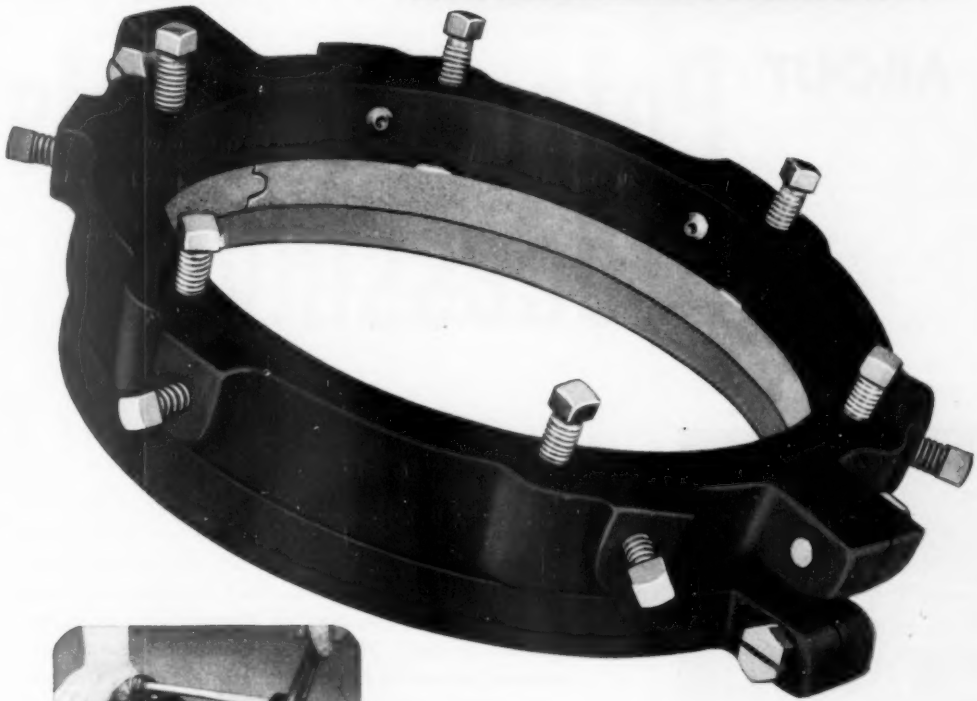
LUFKIN-COOPER-BESSEMER ENGINES

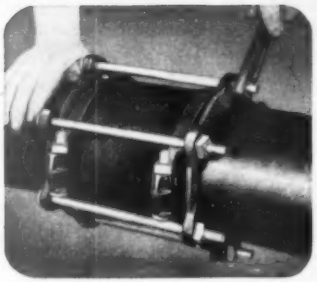
LUFKIN OIL FIELD AND INDUSTRIAL TRUCK TRAILERS

INDUSTRIAL SPEED REDUCERS AND INCREASERS

DIVISION LUFKIN FOUNDRY & MACHINE COMPANY INDUSTRIAL, MILL AND AUTOMOTIVE SUPPLIES

FOR THREAD LEAKS AT FITTINGS





FOR EVERY TYPE OF COLLAR LEAK

SKINNER-SEAL COLLAR LEAK CLAMP, with its sealed gasket and massive construction, stops every type of collar leak.

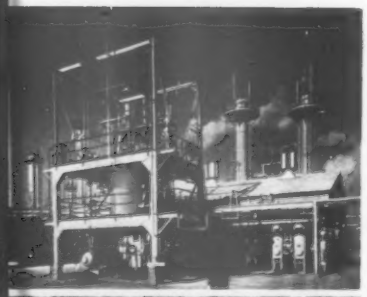
SKINNER-SEAL PIPE JOINT CLAMP stops leaks at joints where pipe is screwed into a fitting. Any temperature — pressures up to 2,000 pounds. A permanent repair — it saves the cost of tearing out and renewing leaky fittings. Prevents shut-downs. This clamp, constantly improved over the years, has been serving the industry for over half a century. In stock at all oil supply stores!

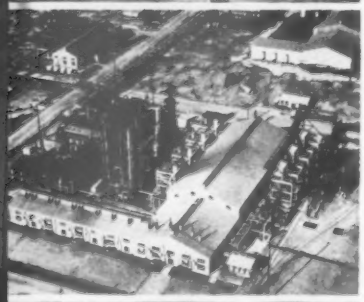
M. B. SKINNER COMPANY, SOUTH BEND 21, IND., U. S. A.

PIPE JOINT CLAMP
COLLAR LEAK CLAMP

SKINNER-SEAL

HERE ARE 5 REASONS WHY YOU SHOULD TALK TO M. W. KELLOGG ABOUT Petrochemicals Processing...





1 **NEW PROCESSES AVAILABLE . . .**
Using new processing techniques, Kellogg is now in a position to design plants for the production of a wide variety of valuable chemicals from hydrocarbon feeds. As a result of recently completed arrangements these include, for example, urea via Montecatini's vastly improved process. Others are ammonia, phenol and acetone, aromatics, higher aliphatic and cyclic alcohols, and phthalic anhydride.

2 **CURRENT PRACTICAL DESIGN EXPERIENCE . . .**
Today, with nearly a score of different chemical plants either under construction or in engineering, Kellogg is able to offer broad chemical experience—all based on the practical chemical engineering philosophy of continuous processing in integrated plants.

3 **EXTENSIVE LABORATORY FACILITIES . . .**
Kellogg pilot plant and organic laboratory facilities are among the most extensive in the industry. The firm is well known among the process industries for its ability to cooperate closely in the development of new proc-

esses—and for its engineering know-how in the translation of pilot plant and semi-commercial plant data into profitable commercial operations.

4 PETROCHEMICAL BACKGROUND . . .

Since World War II when Kellogg engineered butadiene and ammonia plants . . . and later, special units for the production of ethylene, hexylene glycol and ethyl chloride as well as highly efficient fractionation systems for the concentration of butylene . . . the company has continued its research and development work in this expanding field.

5 BASIC ENGINEERING DATA . . .

Behind the relatively new developments in chemical processing, Kellogg has a vast reservoir of technical data built up over years of designing, engineering and erecting petroleum refineries all over the world. Much of this experience is directly applicable to chemical process design.

• • •

If you have a refinery by-product that you wish to upgrade in value to petrochemical intermediate or final product, consider Kellogg's *practical* experience. Write—

Chemical Process Division

THE M. W. KELLOGG COMPANY

KELLOGG — PULLMAN

for fifty-one years an integral part of processing history!

NEW YORK • JERSEY CITY • LOS ANGELES • TULSA • HOUSTON • TORONTO • LONDON • PARIS

These current projects demonstrate Kellogg's versatility in the chemical field . . .

AMMONIA
ISO-OCTYL-ALCOHOL
PHENOL
AROMATICS

In the United States

For Shell — An anhydrous ammonia plant for the West Coast.

For Standard Oil Co. (Indiana) — An iso-octyl-alcohol plant now under construction in the midwest.

For Pan-Am Southern — The first Fluid Hydroformer. Although scheduled to upgrade naphthas to high grade motor gasoline, the unit can alternatively produce aromatics such as benzene, toluene and xylene.

For Cities Service — Two more Fluid Hydroformers, one for the Midwest and the other for the Gulf Coast.

SEVEN PLANT COMPLEX

In Italy for Montecatini — Seven important units for the production of ethylene, propylene, and butylene as well as final products such as isopropanol, secondary butanol and phthalic anhydride.

PHENOL FROM CUMENE

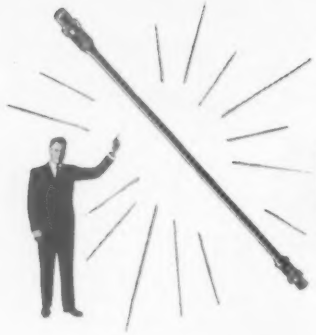
In Canada for B-A Shawinigan — The World's first phenol-from-cumene plant. Scheduled for completion early next year, it promises to provide high quality phenol at low cost.

NAPHTHA PYROLYSIS

In England for ICI — Just completed, a naphtha pyrolysis plant producing better than 99.8% pure ethylene as well as useful by-products such as propylene and butylene. Also for ICI, a phthalic anhydride unit, now in engineering.

GASOLINE FROM COAL SYNTHESIS

In South Africa for SASOL — A large gasoline-from-coal synthesis plant employing Kellogg's Synthol process. Special separation equipment to recover valuable alcohols and other oxygenated chemicals is part of the program.



JONES

SUCKER RODS

JONES has a way of adding strength and fatigue resistance to selected steels. In a special machine, the peening action of thousands of round balls impart a condition of compression to a scale-free surface—smooth it for painting in the distinctive green compound.

THE S. M. JONES COMPANY
Division of Buffalo-Eclipse Corporation
General Office and Factory: TOLEDO, OHIO
Sales Office: Kennedy Building, Tulsa, Okla.
Export Sales Office: Buffalo International Corp.
50 Church Street, N. Y. C.

LOOK FOR THE GREEN RODS

The Petroleum Industry

STOPS RUST!

with

RUST-OLEUM

The Practical Way to Save Pipes, Tanks, Derricks, Buildings, Pumps, Roofs, Fences

Ask the maintenance men who battle rust daily! They'll tell you that RUST-OLEUM is the practical answer. (1) It may be applied directly over surfaces *already rusted* without removing all the rust. Wirebrushing and scraping with sharp scrapers to remove rust scale and loose particles is all that is usually required . . . eliminating costly sandblasting and chemical pre-cleaning . . . often enabling one man to do the work of two. (2) RUST-OLEUM *beautifies as it protects in all colors, aluminum, and white.* (3) RUST-OLEUM *stops rust* on every rustable metal surface indoors and out.

See how RUST-OLEUM can cut your maintenance costs. Prompt delivery from Industrial Distributor stocks in principal cities in the United States and Canada.

RUST-OLEUM CORPORATION
2543 Oakton Street • Evanston, Illinois

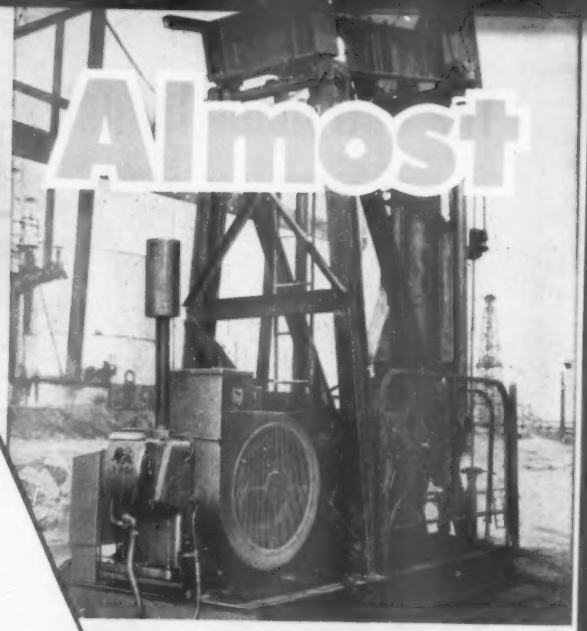
May be applied directly over rusted surfaces without removing all the rust!
Available in All Colors, Aluminum and White

CLIP THIS TO YOUR LETTERHEAD
MAIL TO: RUST-OLEUM CORPORATION
2543 Oakton Street • Evanston, Illinois

- ☐ Have a Qualified Representative Call
- ☐ Full Details on Free Survey
- ☐ Complete Literature
- ☐ Nearest RUST-OLEUM Source

See Rust-Oleum Demonstrated, Booth 1237, Plant Maintenance Show, Cleveland, Ohio

Almost



LE ROI

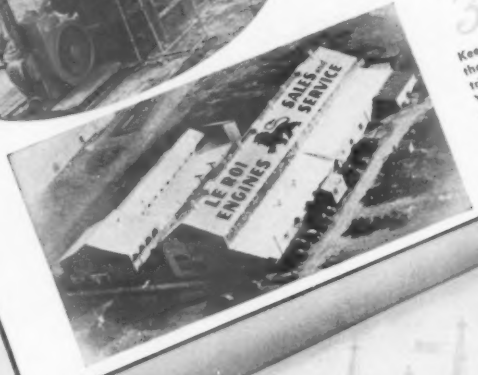
Le Roi 3 way Partnership

1. Better Engines

Le Roi's A288, for example. It has a wide speed range of 360 to 720 rpm. Its removable wet cylinder sleeves and other construction features simplify maintenance, reduce replacement costs. No shut-down is necessary for periodic inspections.

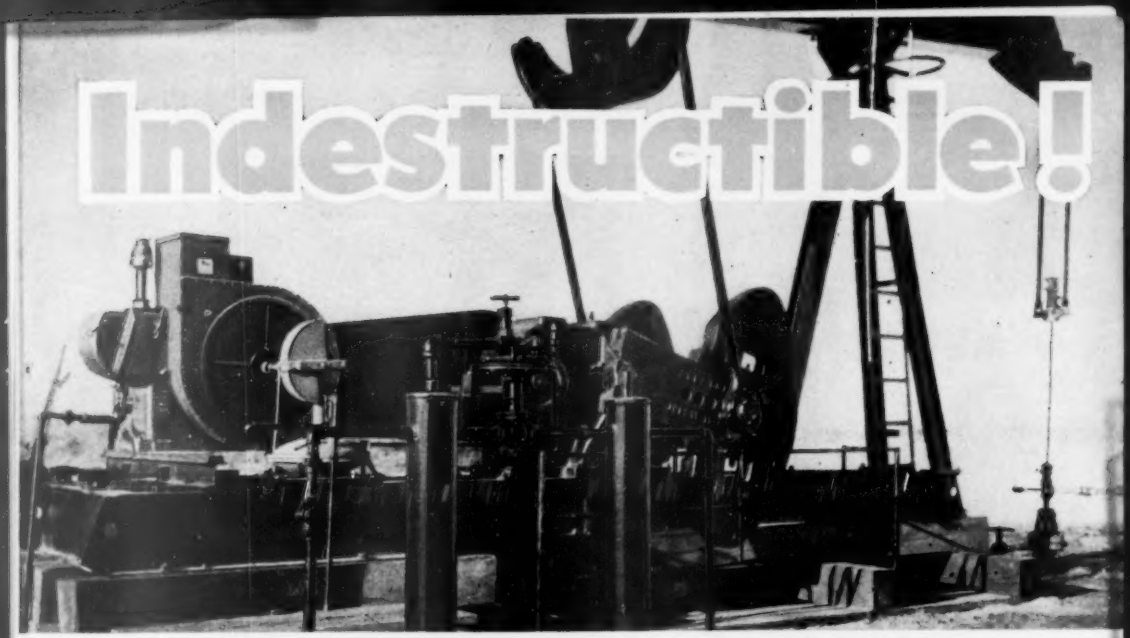
2. Better Applications

Exclusive Le Roi distributors are oil-field power specialists. They know engines. That's why they can select the right power unit for any application. That's why you can count on Le Roi for dependable, low-cost power.



3. Better Service

Keeping your Le Roi engines running is the sole responsibility of our distributors. They handle only Le Roi. You get personal attention from engine experts. Large parts-stocks and skilled mechanics assure prompt service and a minimum of down-time.



Le Roi A288 Pumping Engine

One typical installation shows more than 35,000 hours and it's just beginning its useful life. That's stamina — proof that Le Roi's A288 puts you way ahead of the field!

YOU don't have to pamper this pumping engine. No, sir — not Le Roi's A288. It's built to pump more oil — longer — safer — and with less maintenance — than any other well-pumping engine!

The A288 is the only engine to be recommended by one major pumping-engine user for continuous service *unattended for up to two weeks at a time.*

Here are just a few of the reasons for the A288's unfailing dependability:

- Patented, closed "vaporizing-condensing" cooling system requires almost no make-up water — keeps temperatures high and prevents sludging even in sour-gas areas.
- Heavy flywheel maintains even-speed operation under unbalanced loads.
- You don't have to shut down the A288 for periodic inspections or for adding oil.
- Big crankcase oil capacity permits long intervals between oil filling.
- There are no grease fittings, belts, or other accessories that need attention.

Let your Le Roi distributor tell you more about the A288 — and show you installations. See for yourself why you're way ahead of the field, when you let Le Roi's 3-way partnership work for you.

LE ROI COMPANY

MILWAUKEE 14, WISCONSIN

***Plants:* Milwaukee • Cleveland • Greenwich, Ohio — *Oil Field Headquarters:* Tulsa, Oklahoma**

LE ROI

See these Le Roi Distributors for a Profitable 3-way Partnership

Oklahoma
Le Roi Company Branch — Tulsa
Carson Machine & Supply Co.— Oklahoma City

East & South Texas, Gulf Coast
Southern Engine and Pump Company — Houston, Kilgore, Edinburg, Dallas, San Antonio, Corpus Christi, Texas, and Lafayette, Houma, Louisiana.

North & West Texas, New Mexico
General Machine & Supply Co. — Odessa, Snyder, Texas.
Nortex Engine & Equipment Co.—Wichita Falls, Texas.

Kansas
Carson Machine and Supply Co.—Great Bend

Illinois — Western Kentucky
Western Machinery & Engine Company—Centralia, Illinois and St. Louis, Missouri.

Typical Le Roi Service Facility

Here's the efficient well-arranged parts department of the Le Roi-Rix Co.'s Long Beach branch. Two more offices—at Bakersfield and Los Angeles — are similarly equipped. All three offices maintain prompt 24-hour service. Le Roi has service facilities like these throughout the oil fields — another reason why you can depend on Le Roi.

Michigan
Hafer Engine Service — Reed City

Rocky Mountain Area
Gehring Equipment Co. — Casper, Wyoming, Rangeley, Col.

Northern Louisiana & Mississippi
Ingersoll Corporation — Shreveport, Louisiana, and Jackson, Mississippi.

West Coast
Le Roi-Rix Machinery Co. — Los Angeles, Long Beach and Bakersfield, Calif.

Appalachian Area
P. C. McKenzie Co., Pittsburgh, Bradford.

Canada
Lucey Export Ltd. — Calgary, Edmonton, Alberta.

P-555

Axelson sucker rods, fully heat treated and normalized, are available in sizes and grades for every pumping condition.

AXELSON COUPLINGS INCREASE ROD LIFE

Axelson *hardened* and *ground* sucker rod couplings are designed for increased life of the rod string and the well tubing. Specially developed processes in heat treating and machining give Axelson couplings an extremely hard, highly polished outer surface to resist wear, a metallurgically correct tough interior, which permits machining of threads to withstand shock loads. By accurate threading after heat treatment, there is no possibility of thread distortion, and the sucker rods are held in absolute alignment. Remember—you can argue quality at the surface—but it's *proved* at the bottom of the well.

Chosen for ... to last!

AXELSON

PETROLEUM PUMPING EQUIPMENT

OUR 60th YEAR

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

AXELSON MANUFACTURING COMPANY, Division of Pressed Steel Car Company, Inc. PLANTS —Los Angeles 58, California; St. Louis 16, Missouri. OFFICES—New York City, 7, New York; Tulsa 1, Oklahoma; Buenos Aires, Argentina.

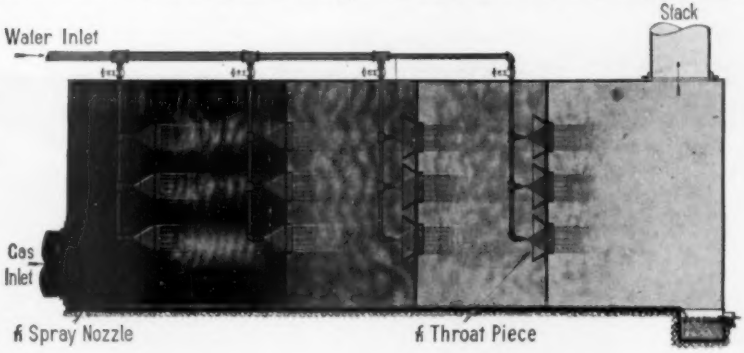
DISTRIBUTORS — Jones & Laughlin Supply Co.; Great Northern Tool & Supply Co.; Industrial Agencies, Ltd., San Fernando, Trinidad; B. W. I.; Industrias Waldrip & Campbell, Barcelona, Caracas and Maracaibo, Venezuela; South American Supply Co., Ltd., Lima, Peru; Sociedad Comercial de Materias Primas Limitado, Rio de Janeiro, Brazil; G. Saavedra e Hijos, S. de R. L. Avenida Morelos 31, Mexico, D. F.; Dominion Oil Field Supply Co., Ltd., Calgary, Canada

TRADE PAPER EDITION
Published by
SCHUTTE and KOERTING Company

ENGINEERING News

JET APPARATUS • HEAT TRANSFER EQUIPMENT • STRAINERS • CONDENSERS AND VACUUM PUMPS • OIL BURNING EQUIPMENT • ROTAMETERS • FLOW INDICATORS • RADIATOR TUBES • VALVES • SPRAY NOZZLES • HD ATOMIZERS • GEAR PUMPS • DESUPERHEATERS

HERE'S HELP IN SCRUBBING GASES OR FUMES



SK Gas Scrubbers are gaining wide application in the petroleum and refining industries because: (1) they have a high scrubbing efficiency rating; (2) they require little maintenance.

These scrubbers will handle gas containing wettable solids and condensable gases as well as gases and solids which can be cleaned by obtaining a chemical reaction between the gas or solids and selected spray liquid.

To meet varying requirements, two types are manufactured by SK—the "Packaged" Gas Scrubber and the Gas Scrubber System. Component parts of both types include the scrubber box, SK Spray Nozzles and Throat Pieces.

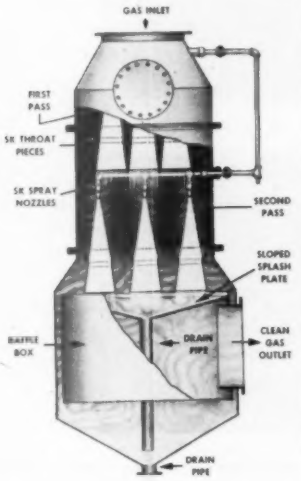


Fig. 4031. SK "Packaged" Gas Scrubber Unit

The Fig. 4031 "Packaged" Gas Scrubber is supplied as a unit and includes an integral separator for separating spray liquid after scrubbing. For Gas Scrubber Systems, SK furnishes spray nozzles and throat pieces and the customer builds the scrubber box to fit the location and requirements. Boxes can be constructed of wood, steel, concrete or other suitable materials, depending upon scrubbing requirements.

The scrubber box, enclosing all components, is divided into compartments or "banks". The number of banks and throat pieces and spray nozzles per bank are determined by the volume and characteristics of the gas and the scrubbing efficiency desired.

Both types of SK Gas Scrubbers operate on the same principle to handle and wash gases. The gas enters the scrubber through an inlet pipe. The suction action of the spray from the nozzles draws the gas into the throat pieces of the first bank in the scrubber, where the liquid and gas are thoroughly mixed. The mixture is discharged into the second bank where it is again entrained and forced through the throat pieces. When the gas leaves the last bank of the scrubber, it has been washed and cooled and it is then discharged through the outlet pipe.

Advantages of SK Gas Scrubbers are: (1) maximum contact between spray liquid and gas; (2) minimum pressure loss; (3) high scrubbing efficiency; (4) low maintenance.

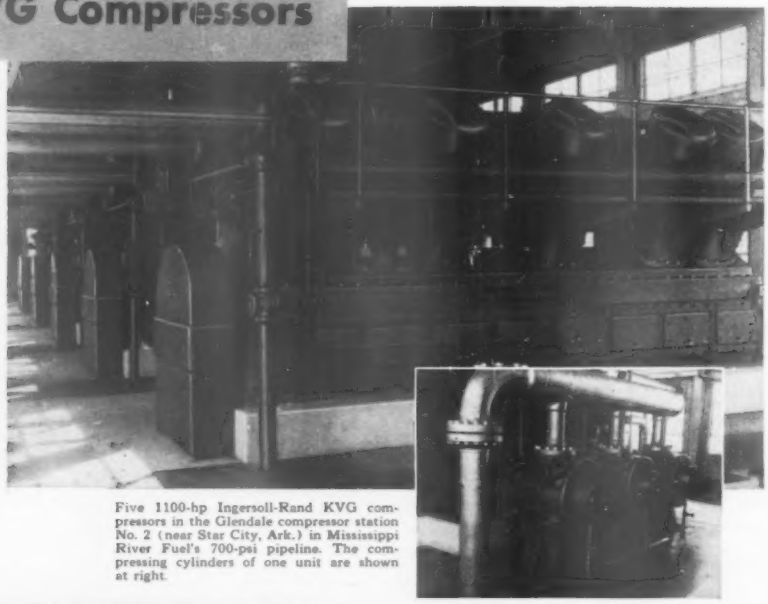
If you want to control gases or fumes, you'll want a copy of Bulletin Supplement 4-RA. It contains full details on SK Gas Scrubbers. We'll be glad to send you a copy on request.

SCHUTTE and KOERTING Company
Manufacturing Engineers
23 CORNWELLS HEIGHTS
BUCKS COUNTY, PA.
Representatives in Principal Cities

63 I-R GAS-ENGINE-

SERVE MISSISSIPPI RIVER FUEL LOUISIANA-TO-ST. LOUIS

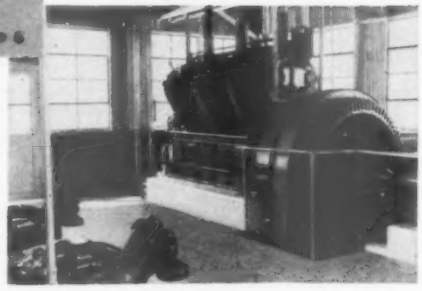
41 KVG Compressors



Five 1100-hp Ingersoll-Rand KVG compressors in the Glendale compressor station No. 2 (near Star City, Ark.) in Mississippi River Fuel's 700-psi pipeline. The compressing cylinders of one unit are shown at right.

and 22 Gas Engine Generating Units...

help deliver daily capacity of 400,000,000 cubic feet of gas



An I-R gas-engine generating unit and two air-starting compressors also serve the same station.

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS •

DRIVEN UNITS

CORPORATION'S VITAL NATURAL GAS LINE

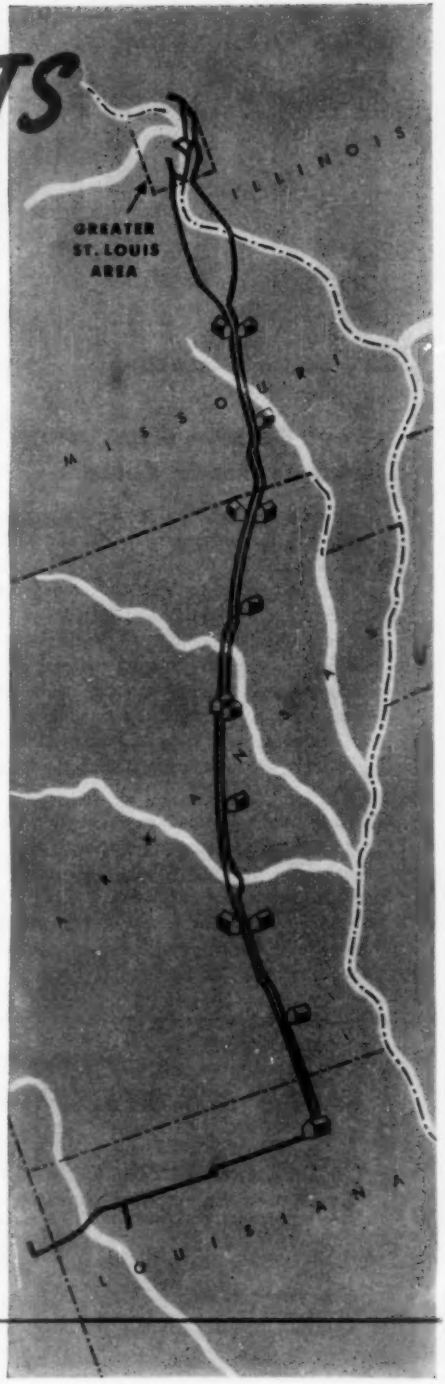
The Mississippi River Fuel Corporation's two 431-mile pipelines supply *all* of the natural gas for the teeming metropolis of Greater St. Louis, leading industrial center of the Mississippi valley. Nineteen compressor stations along the 1466 miles of pipe line, including feeder and lateral lines, provide a capacity of four-hundred-million feet per day.

The gas is carried in two main lines—a low-pressure 22"-line operating at 450 psi and a high-pressure 22"-24"-line operating at 700 psi. The low-pressure line, started in 1929, includes five Ingersoll-Rand KVG gas-engine compressors and nine gas-engine generating units, totalling 7275 hp. The high-pressure line, put into operation in 1949, is served by 36 KVG compressors and 13 gas engine generating units, totalling 39,393 hp. (Two more KVG units are being installed on the line and four more are on order.)

Also included in nine of the compressor stations on the high-pressure line are two I-R Type 30 air-starting compressors. A number of the circulating-water pumps in many of the stations are Ingersoll-Rand, too—totalling more than 75 units. In addition, I-R Impactools and other I-R air tools are used in every compressor station for routine maintenance and plant servicing.

Ingersoll-Rand takes great pride in being able to contribute to the success of Mississippi River Fuel's gas transmission system and in the fact that the performance of *all* I-R equipment has been satisfactory.

For lasting economy and proved dependability in gas-line service or processing plants, get the facts on I-R Gas-Engine-Compressors. Your nearest I-R representative will be glad to serve you.



Ingersoll-Rand

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CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

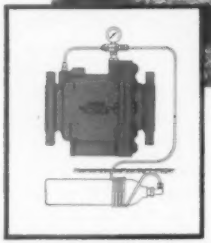
CONTROL

GROVE REGULATORS AND VALVES provide accurate, dependable pressure and flow control for air, gas, oil, water and other fluids. The proved principles embodied in Grove products are the results of years of intensive research and extensive field experience. Today these products are widely used in every branch of industry. Let Grove help with your control problems. Technical information gladly supplied.

Grove Flexflo Regulators for Back Pressure Service

The Flexflo is basically a diaphragm-operated valve, with the only moving part a flexible yet tough expansible tube which serves as both diaphragm and valve. No metallic moving parts to corrode, stick or wedge. No stuffing boxes to leak or freeze. Flexflos cannot fail to close perfectly with bubble-tight shut-off despite foreign particles or minor wear. Instantly responsive to the slightest pressure variations. Action is smooth and quiet, with no damaging slam or chatter. Sizes 1" to 12" for working pressures up to 1500 psi. and temperatures to 150° F.

All these important features add up to reliability. Maintenance-free performance you can count on day in, day out. Longer life under the most punishing field conditions. See how Flexflo's simple operating principle can increase your regulator efficiency. Contact your nearest Grove representative for details.



A Model 888 Grove Flexflo on Separator Gas Line. Pressure loaded operating cylinder is ground insulated against ambient temperature changes.

26102

VALVES AND REGULATORS

GROVE REGULATOR COMPANY

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ACCURACY
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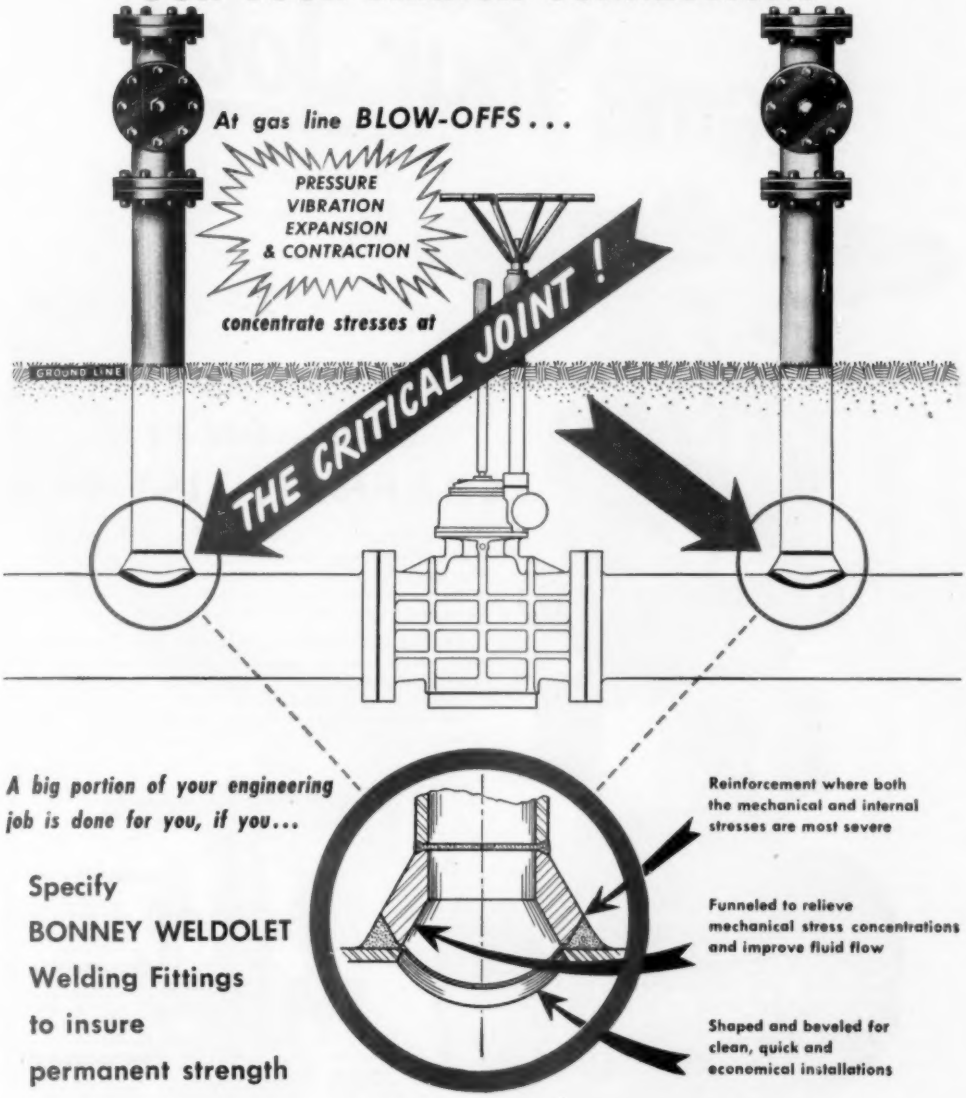
FOR YOUR BRANCH CONNECTIONS



A big portion of your engineering job is done for you, if you...

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BONNEY WELDOLET
Welding Fittings
to insure
permanent strength

Reinforcement where both the mechanical and internal stresses are most severe

Funneled to relieve mechanical stress concentrations and improve fluid flow

Shaped and beveled for clean, quick and economical installations

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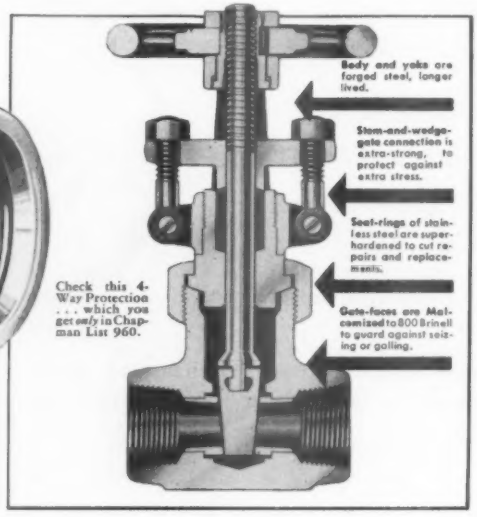
Name Your Job!

If it's for Small Forged Steel Gate Valves... then it's for

CHAPMAN LIST 960

Many different jobs . . . but on each one, List 960 gives you the same top standard of Chapman Valve performance. Check the 4 exclusive Chapman features below . . . and make this your *check list* in buying *all* forged steel gate valves from ½" to 2" inclusive.

Chapman List 960 is manufactured with rising stem, either with yoke as shown, or with inside screw . . . and with gasketed or metal-to-metal bonnet joints. Pressure range: 2,000 lb. at 100°F. to 380 lbs. at 1,000°F. For higher pressures, specify List 990. Have you a copy of Catalog No. 10? Write for it today.


Body and yoke are forged steel, longer lived.
Stem-and-wedge-gate connection is extra-strong, to protect against extra stress.
Seat-rings of stainless steel are superhardened to cut repairs and replacements.
Gate-faces are Malcomized to 800 Brinell to guard against seizing or galling.
Check this 4-Way Protection . . . which you get *only* in Chapman List 960.

The **CHAPMAN VALVE**
MANUFACTURING COMPANY
Indian Orchard, Mass.

No Question about a Reid vapor test when it's made with a Marsh Gauge

THIS REID VAPOR TEST GAUGE is a particularly forceful example of the care with which Marsh Gauges have been designed to meet specific conditions of every branch of the petroleum industry. It has every quality a gauge should possess for the Reid Vapor test—extreme accuracy, tight enclosure, ease of reading and convenience of handling.

The precision movement of this gauge is enclosed in a handsome sturdy, non-corrosive, vapor-proof case of tough Phenol Condensate . . . practically unbreakable; yet extremely light, as a gauge should be for this service. A red, hair-line pointer gives sharp readings on the clear scale. The built-in Marsh "Recalibrator"—easiest and best way to keep a gauge accurate—is an indispensable feature of this gauge in which maintained accuracy is so essential. That convenient, highly polished handle is the finishing touch to a finer testing instrument.

Marsh is the popular gauge for this service for the same reason that it is the preferred gauge for all petroleum services: because it is designed down to the last detail to fulfill a specific set of conditions supremely well.

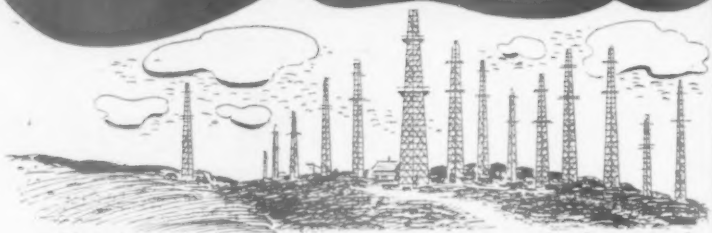
Examine today's finer Marsh line at your supply house

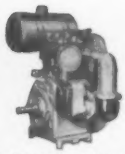
MARSH GAUGES

MARSH INSTRUMENT CO., *Sales affiliate of Jas. P. Marsh Corporation*
Dept. L, Skokie, Ill.
Houston Branch Plant: 1121 Rothwell St., Sect. 15, Houston, Texas

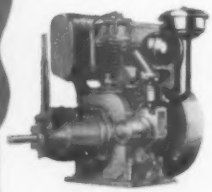
Performance-Proved Field-Tested POWER...

WISCONSIN HEAVY-DUTY Air-Cooled ENGINES

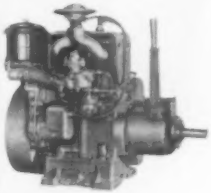




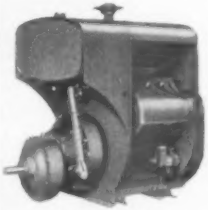
Models ABN, AKN, AEN
4-cycle
Single Cylinder
3 to 8½ hp.



Models AFH, AGH, AHH
4-cycle
Single Cylinder
6 to 9 hp.



Models TE, TF
2-cylinder
7 to 14½ hp.



Models VE4, VF4, VP4D, VG4D — V-type, 4-cylinder
15 to 36 hp.

The fact that Wisconsin Air-Cooled Engines have been given such wide-spread and enthusiastic acceptance in the Oil Field is due to several good, solid factors:

1 **Field-Tested.** Wisconsin-powered equipment is being tested constantly under actual operating conditions by the field staff of Harley Sales Company. Accurate service records determine the advantages and limitations of the units on test, thereby providing the customer with ultraconservative performance claims. The customer knows, in advance of purchase, what to expect . . . and usually his best expectations are more than fulfilled.

2 **Performance-Proved.** Thousands of Wisconsin Heavy-Duty Air-Cooled Engines, ranging from the power-packed little ABN and AKN models (3 to 6 hp.) to the husky VG4D V-type, 4-cylinder job, turning up 36 hp. at 2200 R.P.M., are delivering hard-hitting, dependable power every day, under all conceivable operating conditions. "Most H.P. Hours" of performance-proved service provides tangible evidence of Wisconsin Engine stamina and economy.

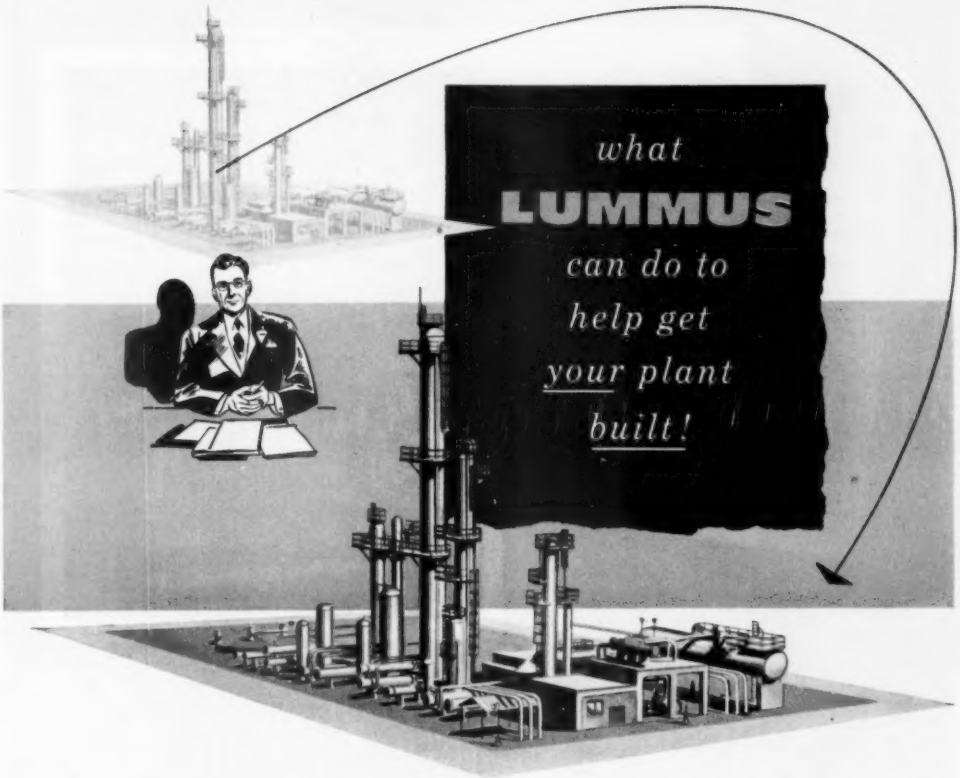
3 **Sellers' Service.** As primary oil field distributors, the Harley Sales Company has full recognition of the need for prompt delivery of equipment and parts and maintains exceptionally large warehouse stocks. Orders for parts are handled the same day they are received.

4 **Manufacturer's Responsibility.** As the world's largest builders of heavy-duty air-cooled engines, the Wisconsin Motor Corporation has a responsibility both to the *seller* and *user* that is fully met and sustained to the limit of our ability.

All this adds up to the kind of a deal that pays off for the power user in terms that are most satisfactory to him.

WISCONSIN MOTOR
Corporation
MILWAUKEE 46, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.
619 S. MAIN STREET, TULSA, OKLAHOMA
M & M BUILDING, HOUSTON, TEXAS
505 SOUTH MAIN ST., WICHITA, KANSAS
OIL FIELD DISTRIBUTORS FOR WISCONSIN ENGINES AND ALL TYPES OF UTILITY UNITS.



Design, engineer and construct it? Of course. These three main classes of service—performed under *one* contract with *single* responsibility—are our bread and butter. They have produced more than 600 plants of all types in just about every country where petroleum is refined or chemicals are made.

Today's conditions, however, call for departures from "routine." Otherwise, endless complexities, shortages, etc., could require three times the normal effort to get a plant built. But Lummus has the quality and versatility of staff—the breadth and depth of operations, to meet these conditions head-on and help you maintain near-normal status.

It could work like this. In the interest of "first things first," you may need basic studies and reports covering alternative routes for reaching your goal. If so, rely on Lummus to develop analyses on which to base sound capital investment decisions.

Perhaps your problem is not so much with process units themselves, but with tying the whole system together for full operating efficiency. Lummus has long-established experience in laying out and installing complete off-site facilities—the bringing in of utilities—piping to introduce charge materials and carry off products—tankage, dockage, loading facilities, etc. This is "know-how" you can use to advantage.

Among other added factors are the considerable help we afford in procuring materials, and invaluable counsel in interpreting government rules and regulations—all in all, unique services geared to the times.

We invite you to use our various services, either singly or in combination—to get that plant *built!*

THE LUMMUS COMPANY

385 MADISON AVENUE, NEW YORK 17, N. Y.

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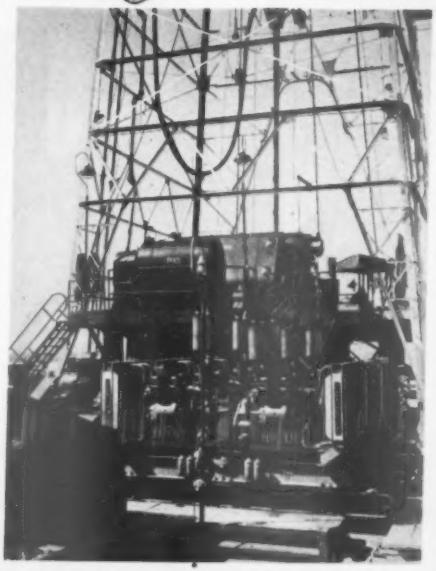
DESIGNING ENGINEERS AND CONSTRUCTORS FOR THE PETROLEUM AND CHEMICAL INDUSTRIES

GM DIESEL
CASE HISTORY No. 47-903

USER: Coastal Drilling Co., Bakersfield, Calif., operating in San Joaquin Valley.

INSTALLATION: Three GM Diesel Quads, powering an Emsco J-1250 rig and two 8" x 20" Gardner-Denver mud pumps. Engines were purchased August 1, 1947.

PERFORMANCE: Three Quads have each operated 38,000 hours and never been off the rig for repairs. One of them operated 23,000 hours before pistons and liners were changed right on the rig.



This Diesel has worked 38,000 hours

without being off the rig for repairs

For five full years these three General Motors Diesel Quads have been drilling wells without needing to be removed from the rig. Costly down time is reduced to a minimum with GM Diesel multiple engine units because one engine can be serviced while others keep working. With good maintenance and parts replacement when needed, GM Diesels give thousands of hours of dependable service. They're compact—fit within road width—are easier to move. Two-cycle operation gives them full acceleration for quicker round trips. Investigate GM Diesels before specifying power for your next rig.

DETROIT DIESEL ENGINE DIVISION
GENERAL MOTORS • DETROIT 28, MICHIGAN

It pays to Standardize on

GM
GENERAL MOTORS
DIESEL
POWER

everything that's **NEW . . .**

all that's **STANDARD**

At this year's end, the increasing demand for new and better drilling machinery, for more efficient production equipment, promises in 1953 another impressive chapter in the growth of the petroleum industry.

Research and product development at National Supply move ahead at a steady pace, too—pausing only long enough for a quick review, and the setting of sights on new objectives.

Milestones of progress include the completion of a full line of modern Ideal rigs and blocks for every depth and every drilling condition, the Ideal Multimatic Rotary with its many advantageous features, the rugged Dy-a-Flex clutch for more flexible power transmission, the new Spangweld drill pipe, significant improvements in our Superior Diesel Engines, and the extension of our equipment and supply service to six new locations in the oilfields.

During the coming months and years, these and many other products will be available through 114 National Supply Stores from Odessa, Texas to Swift Current, Saskatchewan, as well as at all major oil fields throughout the world where overseas representatives aid in application engineering. Ask about the whole line of "National Blue" equipment next time you stop at one of the familiar "cross-road" stores, where you'll find everything that's new and all that's standard in oil field machinery.

THE NATIONAL SUPPLY COMPANY

Pittsburgh 30, Pennsylvania

velocity enough for jet drilling ...

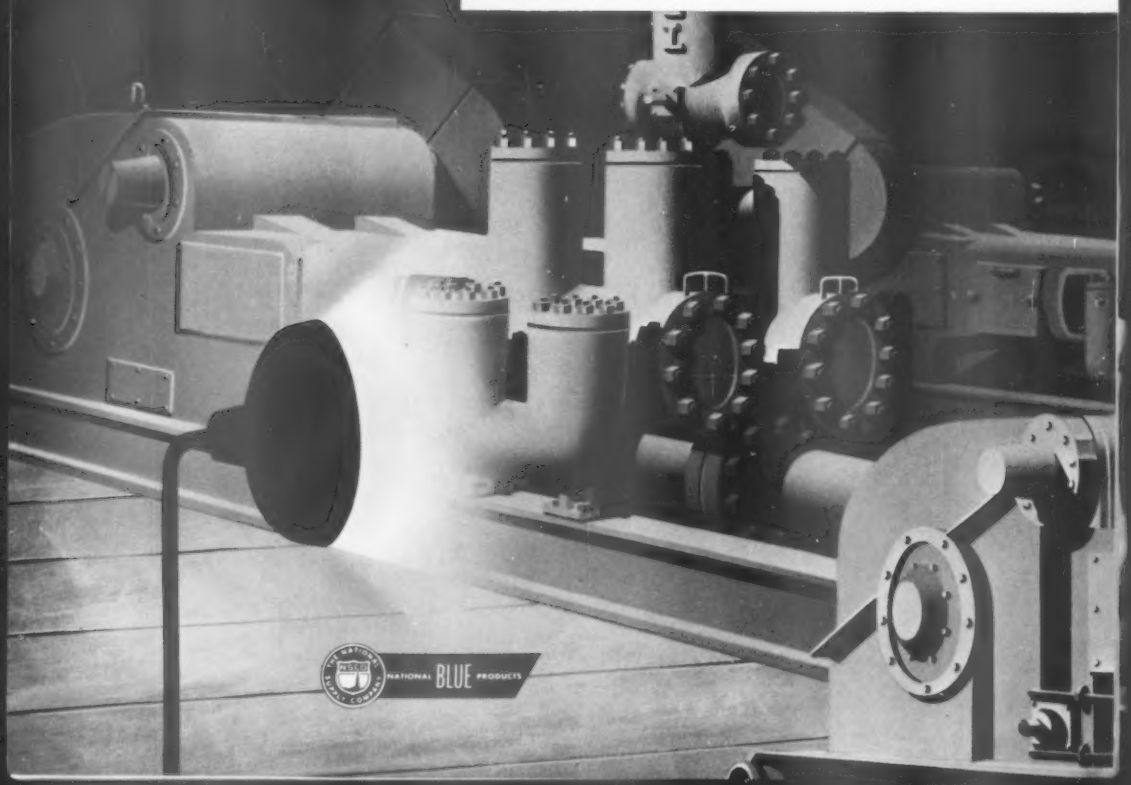
... NATIONAL IDEAL®

More than forty years of slush pump engineering, and as many years of field application research, back up the design and construction features of modern "Ideal" Slush Pumps.

But still the research goes on, a complicated study of slush pump performance, fluid end requirements, fluid capacities and pressures, drilling fluid characteristics. Furthermore, this study of slush pumps parallels other National Supply investigations of related drilling machinery and tubular products.

As a result of these coordinated programs of research and product development the user of National "Ideal" Slush Pumps can obtain equipment in a complete range of sizes for every present-day drilling need from a single source of supply. Furthermore, every National Supply Store carries a full stock of "Ideal" Fluid End Parts designed to keep pumps operating at maximum efficiency.

The latest composite catalog contains a section with descriptions and ratings for "Ideal" Slush Pumps in capacities ranging from 50 to 700 hydraulic horsepower output. For more detailed information, inquire at your National Supply Store or write for bulletins.



volume enough for deepest wells

SLUSH PUMPS

THE NATIONAL SUPPLY COMPANY

Pittsburgh 30, Pennsylvania

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Tulsa • Torrance

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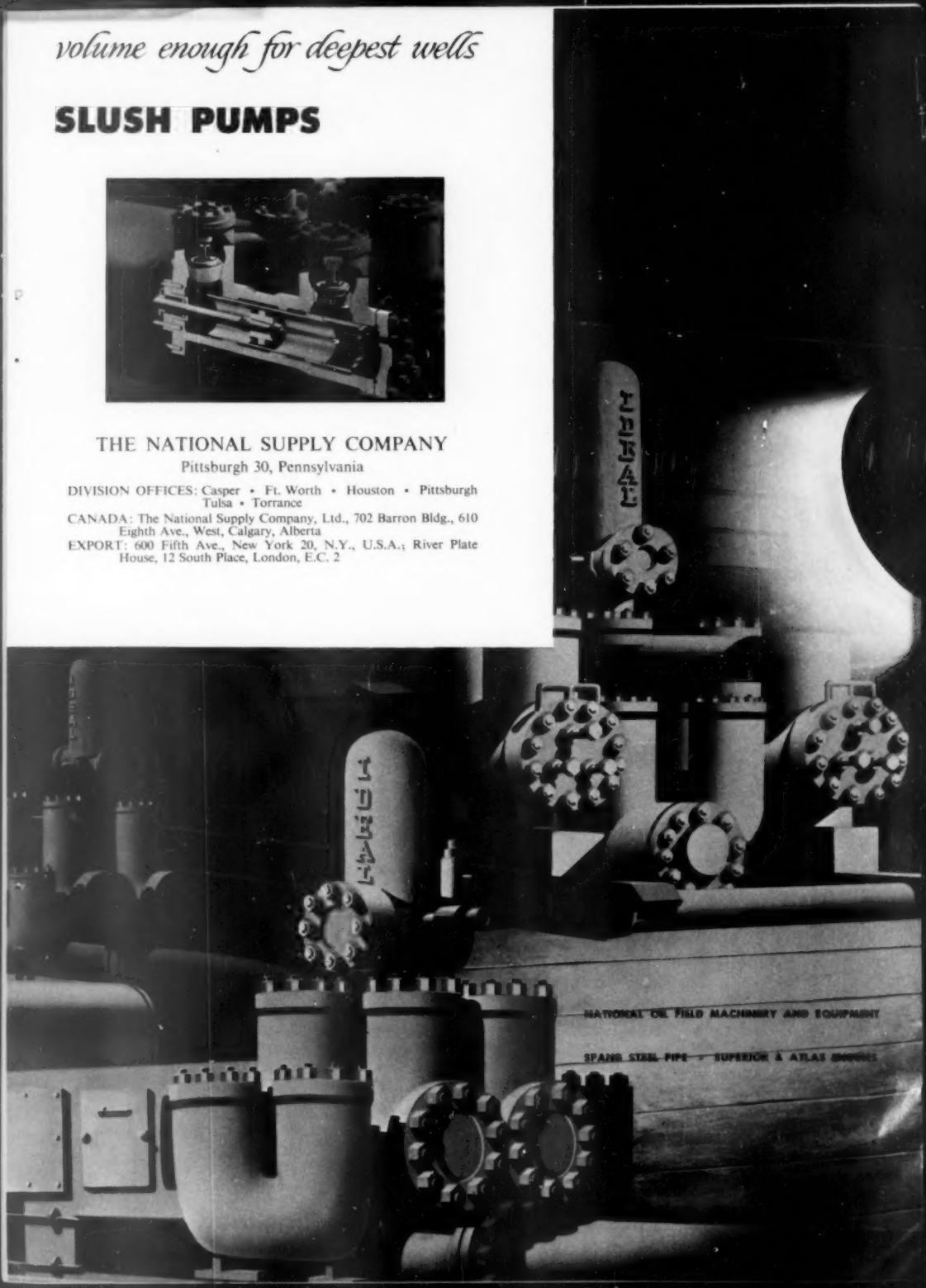
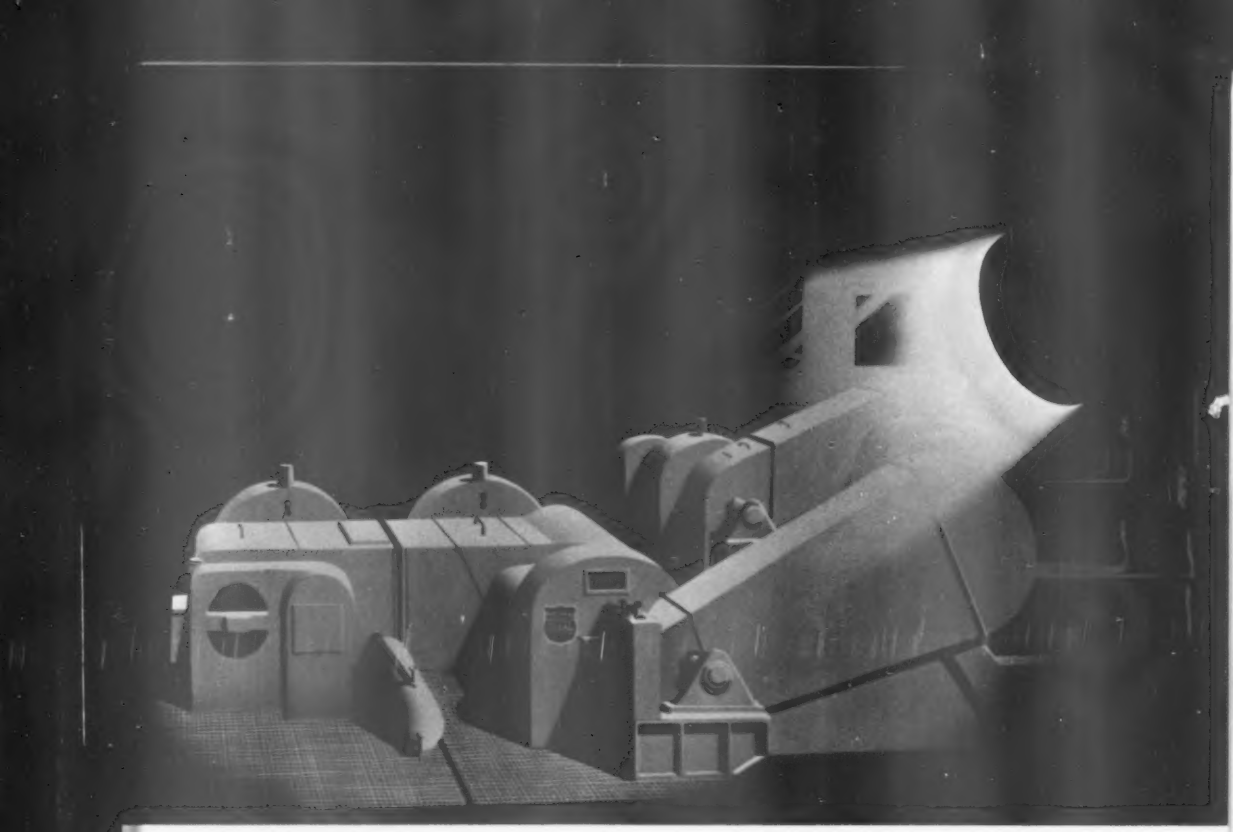
EXPORT: 600 Fifth Ave., New York 20, N.Y., U.S.A.; River Plate House, 12 South Place, London, E.C. 2





. . . and maximum operating flexibility with IDEAL®

INDEPENDENT PUMP DRIVES

Where drilling operations require additional fluid volume and velocity, this extra circulating capacity can be readily obtained by a separate system utilizing "Ideal" Slush Pumps, "Ideal" Independent Pump Drives, and Superior Engines, either diesel, gas or dual-fuel.

Built in single-engine and multiple-engine types for the complete range of "Ideal" Slush Pumps, "Ideal" Independent Pump Drives are sectionalized in the same manner as Ideal Consolidated Rigs and Drive Groups. Other features of this complete and flexible line of independent slush pump drives include—

- Engine clutch power take-off with single or 2-speed transmission for smaller pumps.
- Fluid drive (Ideal-Gyrol), torque converter or air-actuated (Airflex) clutch with V-belt, or chain drive.
- Dual-pump combinations for separate or dual pump operation with one or two driving engines.

Basic information on Ideal Independent Pump Drives is contained in the composite catalog. For application details on equipment to meet any specific requirement, write National Supply at Pittsburgh.

THE NATIONAL SUPPLY COMPANY

Pittsburgh 30, Pennsylvania

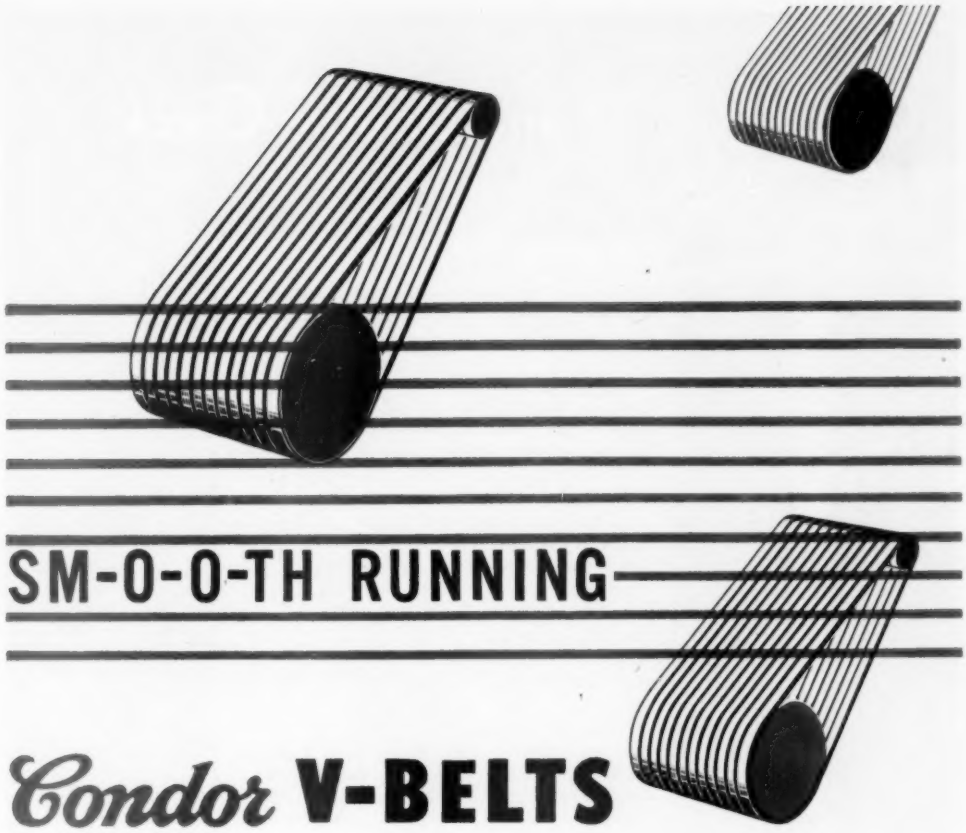
DIVISION OFFICES: Casper • Ft. Worth • Houston • Pittsburgh
Tulsa • Torrance

CANADA: The National Supply Company, Ltd., 702 Barron Bldg., 610 Eighth Ave., West, Calgary, Alberta

EXPORT: 600 Fifth Ave., New York 20, N.Y., U.S.A.; River Plate House, 12 South Place, London, E.C. 2

NATIONAL BLUE PRODUCTS

NATIONAL OIL FIELD MACHINERY AND EQUIPMENT • SPANG STEEL PIPE • SUPERIOR & ATLAS ENGINES



SM-O-O-TH RUNNING

Condor V-BELTS

You get long belt life and low belt costs with Condor V-Belts because they are the smoothest running V-belts made. These are the Raybestos-Manhattan engineering reasons . . . Pulling section is micro-positioned, where engineering says it should be . . . Straight sidewalls give more grip, less slip, longer life . . . Every part of belt is precision-balanced. Other advantages are described in Bulletin 6868D. Write for a copy . . . or call your R/M Distributor • We can show you also how equally good engineering in R/M hose, conveyor and transmission belts helps "smooth out" production problems.

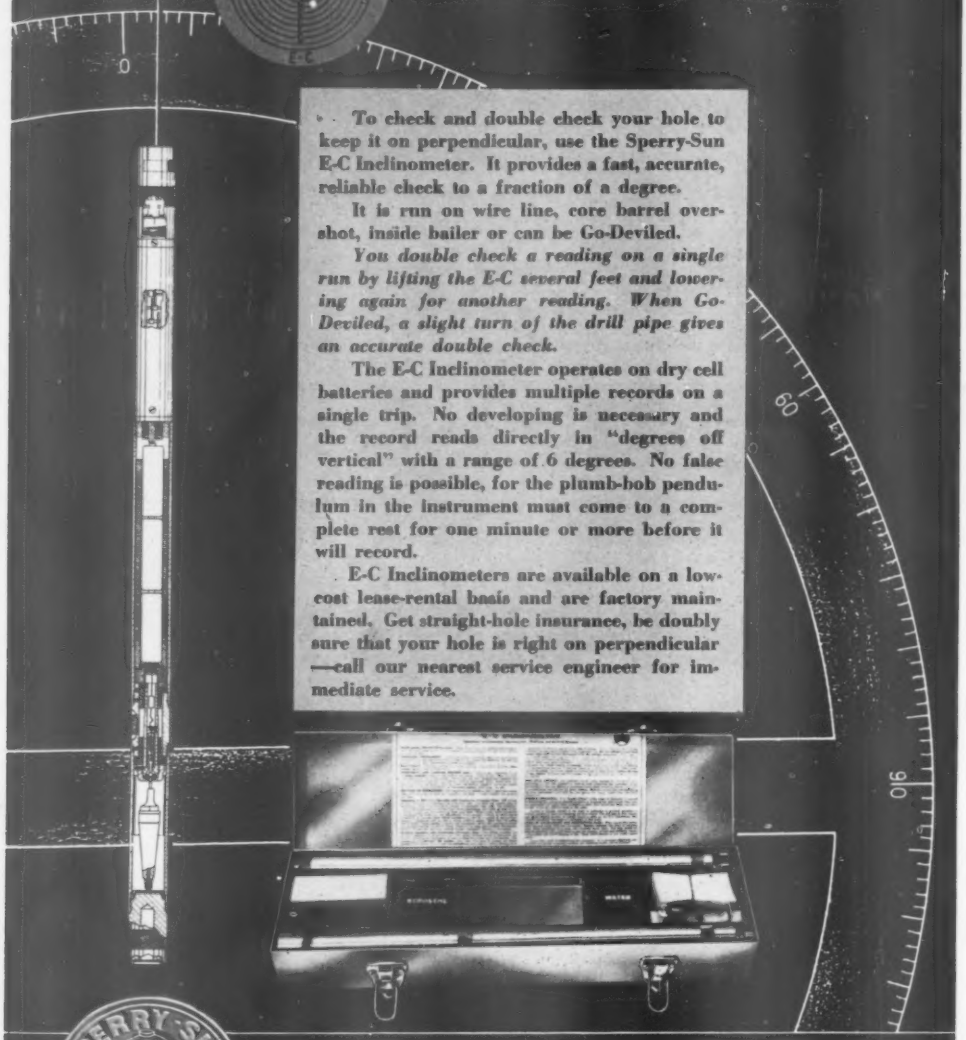
R/M

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS - MANHATTAN, INC.

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Packings • Brake Linings • Brake Blocks Clutch Facings • Asbestos Textiles • Sintered Metal Parts • Bowling Balls

Check and Double Check



To check and double check your hole to keep it on perpendicular, use the Sperry-Sun E-C Inclinometer. It provides a fast, accurate, reliable check to a fraction of a degree.

It is run on wire line, core barrel overshot, inside bailer or can be Go-Deviled.

You double check a reading on a single run by lifting the E-C several feet and lowering again for another reading. When Go-Deviled, a slight turn of the drill pipe gives an accurate double check.

The E-C Inclinometer operates on dry cell batteries and provides multiple records on a single trip. No developing is necessary and the record reads directly in "degrees off vertical" with a range of 6 degrees. No false reading is possible, for the plumb-bob pendulum in the instrument must come to a complete rest for one minute or more before it will record.

E-C Inclinometers are available on a low-cost lease-rental basis and are factory maintained. Get straight-hole insurance, be doubly sure that your hole is right on perpendicular —call our nearest service engineer for immediate service.

SPERRY-SUN

SPERRY-SUN WELL SURVEYING COMPANY

3118 BLODGETT AVENUE HOUSTON, TEXAS

Philadelphia, Pa. Falfurrias, Texas Odessa, Texas Marshall, Texas Long Beach, Calif. Oklahoma City, Okla.
Lafayette, La. Bakersfield, Calif. Moulden Oil Field Services, Casper, Wyo. Crossville, Illinois

J&L INTEGRAL* JOINT DRILL PIPE

Made of
BLUE RIBBON STEEL

*INTEGRAL.
Essential to completeness. Integrated; composite; as an *integral* whole. Lacking nothing of completeness.
— Webster.

Jones & Laughlin Supply Company

EXPORT: 405 Lexington Ave., New York, N. Y., U. S. A.
88 STORES • 19 OFFICES • 9 RESIDENT SALESMEN
General Offices: TULSA, OKLAHOMA

J&L STEEL
Subsidiary of Jones & Laughlin Steel Corporation

No Limit!

to types of G-R Tubular

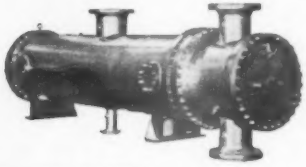
Some Types of
G-R TUBULAR EXCHANGERS

LIQUID AND GAS COOLERS AND HEATERS

Each unit tailored for specific requirements to assure best results

REBOILERS

To produce vapor from hydrocarbon or other liquids, heated by steam or hot liquids

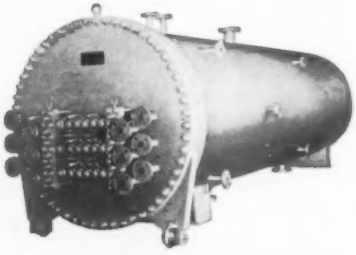


FEEDWATER HEATERS

For low, medium and high pressures and for a wide range of capacities

EVAPORATORS

To produce distilled water for boiler feed make-up, and for generating steam for process work



STEAM GENERATORS

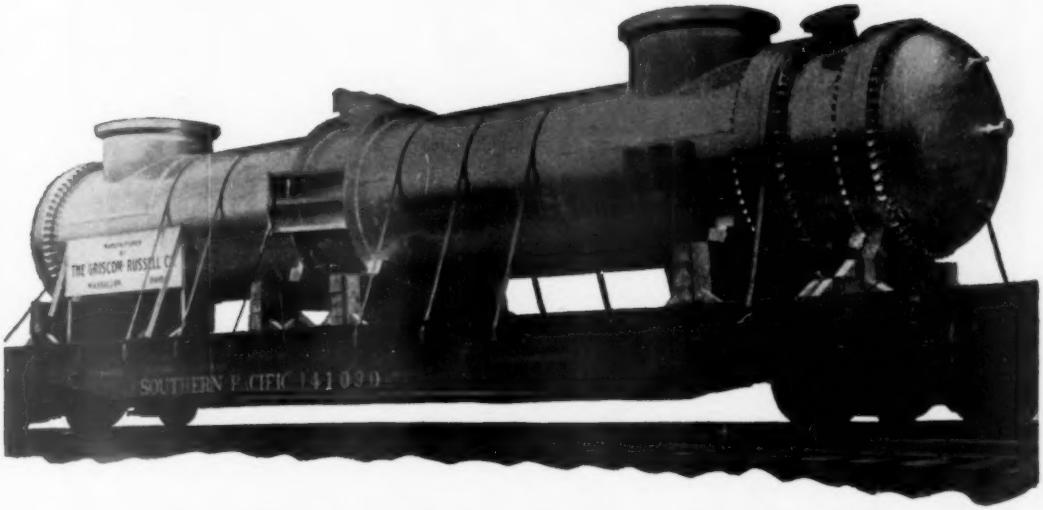
To generate steam at boiler pressure from raw, untreated water, using heat otherwise wasted in gas oil and tar streams

GR-276A

GRISCOM-RUSSELL

PIONEERS IN HEAT TRANSFER APPARATUS

Heat Exchangers



This huge unit, occupying the full length of a 53-ft flat car on its way from the Griscom-Russell plant, is one example of the G-R manufacturing facilities for heat transfer apparatus.

At the other extreme are G-R Heat Exchangers that can be readily handled by one man.

Between these two extremes are the many types of G-R Heaters, Coolers, Condensers, Evaporators and Heat Exchangers, of which Griscom-Russell has built almost 200,000 to handle all types of liquids, gases and vapors for all industries.

Each G-R design is based on the 85-year specialized experience of the oldest and largest exclusive manufacturer of heat transfer apparatus. Each type has many distinctive features that assure superior effectiveness, economy and durability.

Write for 32-page bulletin describing G-R Tubular Heat Exchangers in detail.

THE GRISCOM-RUSSELL CO., MASSILLON, OHIO

No Farrel® Speed Increaser has ever failed in pipeline service

Twenty years ago Farrel developed the first standard series of speed increasers for pipeline pumping service. The original units shipped that year, *as well as all of those installed since*, are still in operation, performing as well as on the day they were placed in service. Not one has ever failed on the job.

This record provides a virtual guarantee of trouble-free performance... day after day...year after year. Power transmission remains smooth and quiet under the most adverse conditions—continuous heavy-duty operation, dust, rain, sandstorms, severe heat and intense cold.

Farrel speed increasers are available in 49 standard sizes, with speed ratios ranging from 1:1 to 12:1. For higher ratios, units using two sets of gears are supplied with ratio range from 12:1 to 40:1.

Send for full information. Ask for a copy of Bulletin No. 448A.

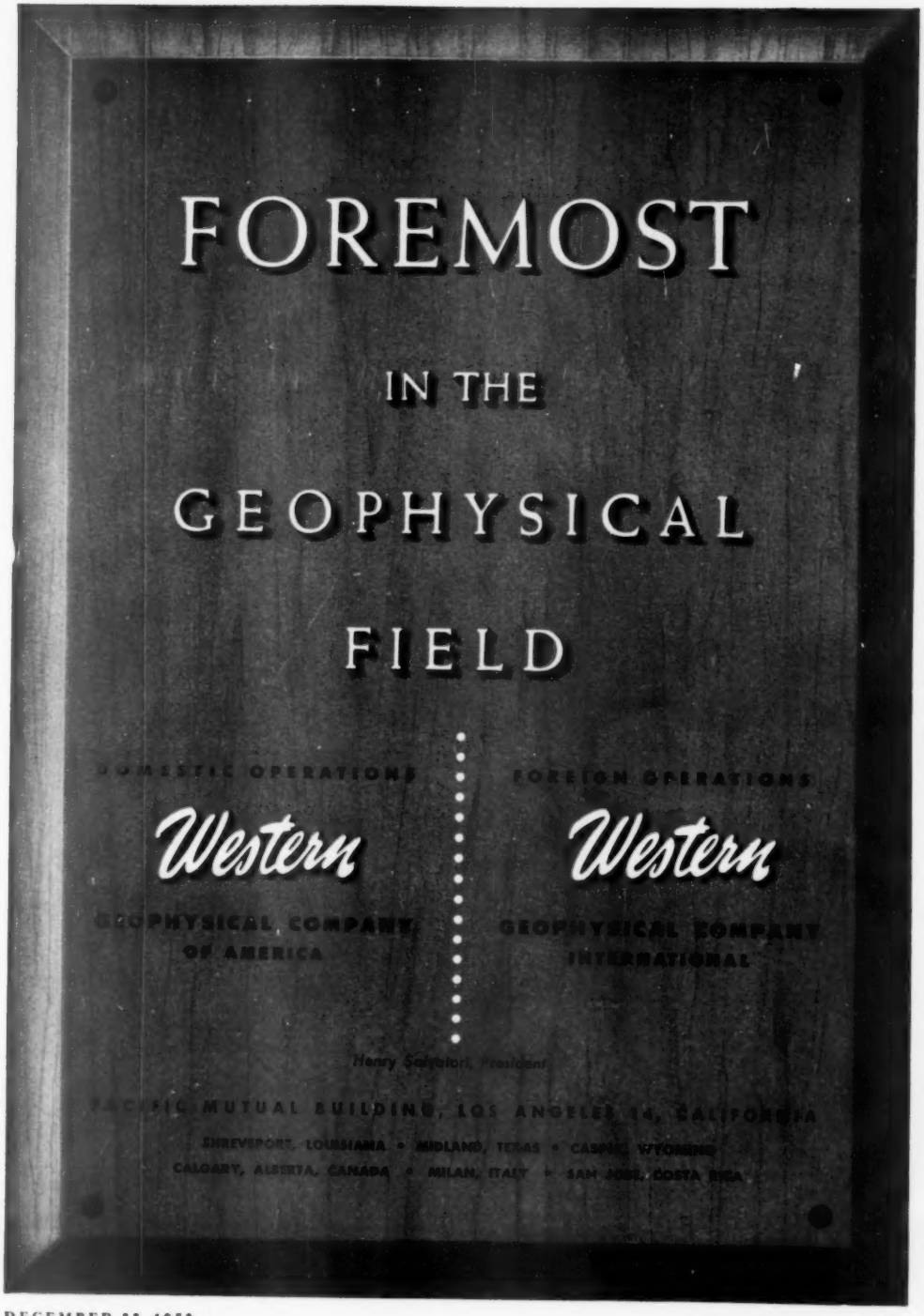
FARREL-BIRMINGHAM COMPANY, INC. • ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Boston, Pittsburgh, Akron, Detroit, Chicago, Memphis, Minneapolis, Portland (Oregon), Los Angeles, Salt Lake City, New Orleans

OIL FIELD REPRESENTATIVES
Hercules-Lupfer Engine Sales Co., 124 N. Boston St., Tulsa 1, Okla.
V. W. Osborne, 860-A M&M Building, Houston 2, Texas

Farrel-Birmingham®

FB-779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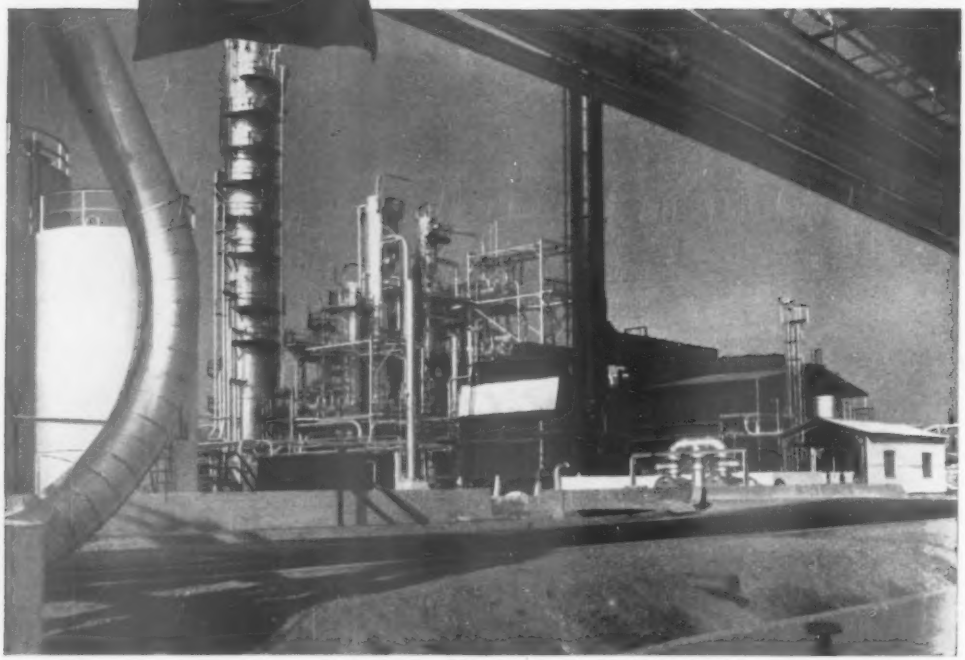
C.F.R. chooses QO-Furfural



Compagnie Française de Raffinage, Raffinerie de Normandie, Gonfreville, France.

Photo by permission of Société D'Éditions Photomécaniques, Paris

This new lubricating oil refining unit using QO-furfural as the selective solvent went on stream this year at the Normandy refinery of Compagnie Française de Raffinage at Gonfreville, France. This modern efficient plant assures C.F.R.'s customers of a reliable source of high quality lubricants.

It has been thoroughly proved around the world that furfural refining produces excellent yield of oils having high viscosity indexes, as well as exceptional resistance to sludging and other changes effected at high temperature motor operation. The process is simple, economical, and easily controlled.

Some of the factors which made furfural C.F.R.'s logical choice as the selective solvent were high selectivity, solvent stability, ease of recovery, economy, and freedom from toxicity.

Selective solvent treatment is used extensively in refining petroleum, but the technique is a useful tool in processing non-petroleum products as well.

Write to any of the offices listed below for information about the physical and chemical properties of furfural. Also, we shall be glad to put you in touch with the licensors of the process for further information concerning the process itself.

The Quaker Oats Company — **CHEMICALS DEPT.**

339F The Merchandise Mart, Chicago 54, Illinois
Room 539F, 120 Wall St., New York 5, N. Y.
Room 439F, P. O. Box 4376, Portland 8, Oregon

In San Francisco: The Griffin Chemical Company • In the United Kingdom: Imperial Chemical Industries, Ltd., Billingham, England
In Europe: Quaker Oats-Graanproducten N. V., Rotterdam, The Netherlands; Quaker Oats (France) S.A., 3, Rue Pillet-Will, Paris IX, France
In Australia: Swift & Company, Pty., Ltd., Sydney • In Japan: F. Kanematsu & Company, Ltd., Tokyo

FOR SAFE MUD CONTROL...

When your drill pipe starts to stick—whenever you face a drilling emergency that can be controlled by skillful mud handling—it's good to know your GARDNER-DENVER SLUSH PUMP has the strength—and to spare.

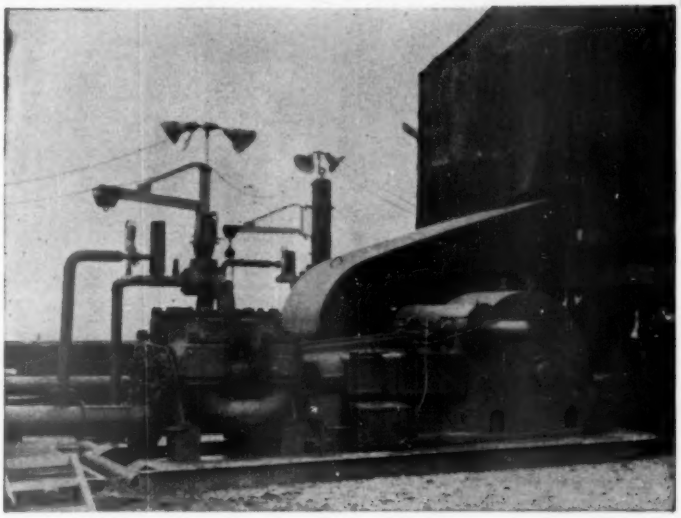
That's because of—

***Extra tough fluid end*—Gardner-Denver alloy high pressure cylinders—every cylinder tested to pressures far above those met in use. Divided cylinder construction.**

***Improved liner packing*—"telltale" construction reveals leakage before any damage occurs.**

***Extra precautions* keep all mud, water and dust out of the power end—dust-proof cover—improved piston rod packing—rod flushing pipe—rubber piston rod baffle—mud-stop and oil-stop heads.**

***Plus:* One-piece main frame, exclusive rigid main shaft, eccentric construction, herringbone gears, and automatic lubrication with continuous bath of clean, filtered oil. Made in NINE sizes, from 15 h.p. to 750 h.p. Write today for complete specifications.**



Gardner-Denver Slush Pumps are designed to save maintenance time, too!

Divided fluid cylinders simplify replacement—can be welded.

Exceptionally accessible—liners, pistons and rods can be changed without opening crankcase.

Individual valve pot covers permit quick inspection or replacement of any valve.

These, and many other features, speed maintenance in the field.

SINCE 1859

GARDNER-DENVER

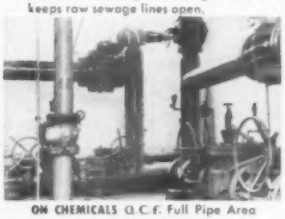
Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., Toronto, Ontario
THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS

Dallas • Houston • Tulsa • St. Louis • Los Angeles • San Francisco • New York
Chicago • Pittsburgh • Denver • New Orleans
Continental Supply Co., Continental Bldg., Dallas, Texas
Export Division: 30 Rockefeller Plaza, New York, N. Y.
Republic Supply Co., (Of Calif.), 2600 S. Eastland Ave., Los Angeles, Calif.

ON NATURAL GAS Q.C.F. **CYLINDRICAL** Plug Valves have no obstruction to flow, quick quarter-turn shut-off.

This Q.C.F. Full Round Port CYLINDRICAL PLUG VALVE—with all its sound, true economy features—is made especially for critical installations where uninterrupted, fast flow is a necessity. Q.C.F. Round Port Valves are available in sizes up to 12 inches. Q.C.F. Rectangular Port Valves also offer full pipe area. *And here's a new, added feature!* Q.C.F. Valves are now available with TEFLON head gaskets, for easier turning, greater protection against leakage on difficult services. When next you specify, why accept less—ask for Q.C.F.

IN SEWAGE PLANTS the Q.C.F. Valve provides knife-edge, shearing action, keeps raw sewage lines open.



ON CHEMICALS Q.C.F. Full Pipe Area stops abrasion from suspensions, no contamination of ladings.

Q.C.F. CYLINDRICAL FULL PIPE AREA PLUG VALVES

Write for Catalogue 4-OG. American Car and Foundry Co., Valve Division, 1501 E. Ferry Ave., Detroit 11, Mich.

Representatives in 50 Principal Cities

Thirtieth Anniversary

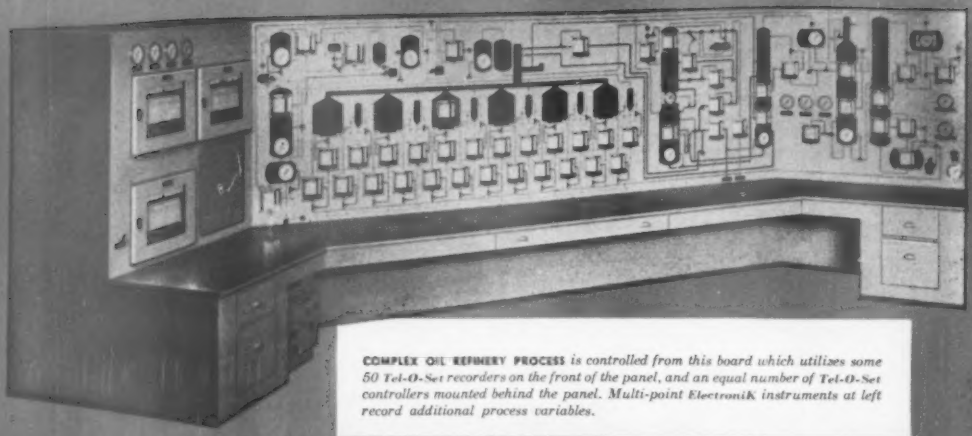
TULSA

MAY 14-23
1953

EXPLORATION
DRILLING
PRODUCTION
PIPE LINE
REFINING
SCIENTIFIC

To Those Who Will Attend

Requests for accommodations should be sent as soon as needs can be determined. Address International Petroleum Exposition Housing Bureau, 616 South Boston Avenue, Tulsa, Oklahoma.

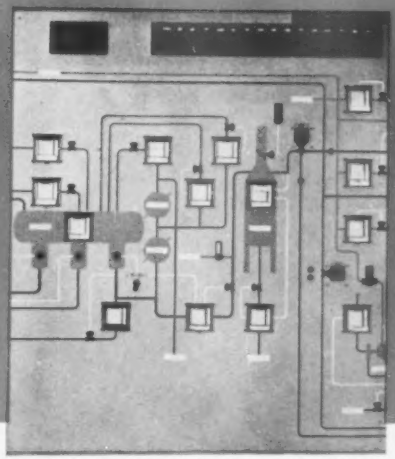


COMPLEX OIL REFINERY PROCESS *is controlled from this board which utilizes some 50* Tel-O-Set *recorders on the front of the panel, and an equal number of* Tel-O-Set *controllers mounted behind the panel. Multi-point* ElectroniK *instruments at left record additional process variables.*

Graphic Panels for Centralized Instrumentation...

These well-known companies are taking advantage of Honeywell's specialized knowledge in the design, construction and operation of graphic panels:

Bechtel Corporation
C. F. Braun
Canadian Oil Refineries
Catalytic Construction Co.
Cooperative Refinery Association
Day & Zimmerman Inc.
Derby Oil Co.
Farmers Union Central Exchange Refinery Inc.
The Fluor Corporation Ltd.
Foster-Wheeler Corp.
Great Lakes Refinery
Imperial Oil of Canada
Inter-Mountain Chemical
International Refineries, Inc.
Kanotex Refining Co.
The Lummus Company
Northwestern Refinery
Pan-Am Southern
Phillips Petroleum Co.
The Refinery Engineering Co.
Rohm and Haas Co.
Shell Oil Co.
Sinclair Refining Co.
Socony-Vacuum Oil Co.
Southwestern Engineering Co.
Standard Oil Co. of California
Standard Oil Co. of Indiana
Standard Oil Co. of New Jersey
Sunray Oil Corp.
Sutherland Refiner Corp.
Union Oil Co. of California
Vickers Petroleum



FUNCTION-DESIGNED CONTROL *for a large refinery includes this section in a large graphic panel by Honeywell—using front-of-panel Liquid Level Indicators and* Tel-O-Set *recorders, plus* Tel-O-Set *controllers behind the panel.*

PANEL PRODUCTION
in Honeywell's extensive shop, devoted exclusively to panel work—utilizes the skills of highly trained specialists. All instruments, controllers, accessories, and back of panel wiring and piping are carefully assembled —then subjected to rigorous tests to assure trouble-free installation and start-up when the panel reaches your plant.

. . . a progress report from Honeywell

SHOWN at the left are just two of the many graphic instrument panels which Honeywell has supplied for centralized control of a wide variety of industrial processes. Each one is the result of well-seasoned engineering know-how . . . based on extensive Honeywell experience . . . which combines all instruments and accessories into a closely integrated, efficient design.

Whether your process calls for a full graphic or semi-graphic panel . . . a conventional board . . . or a control cubicle . . . you can be sure of obtaining every feature of quality and performance that you need in a Honeywell panel.

In Honeywell's Panel Division, meticulous attention to engineering detail and highly developed construction techniques watch over every step—from blueprint to assembly to final test. Add to this engineering and manufacturing skill the availability of a complete line of conventional and miniature instruments, and the result is a control board . . . custom-fitted to your needs . . . that makes *Panels by Honeywell* synonymous with the best in centralized control.

Our local engineering representative will be glad to discuss how graphic panels by Honeywell can bring new efficiency to your processes. Call him today . . . he is as near as your phone.

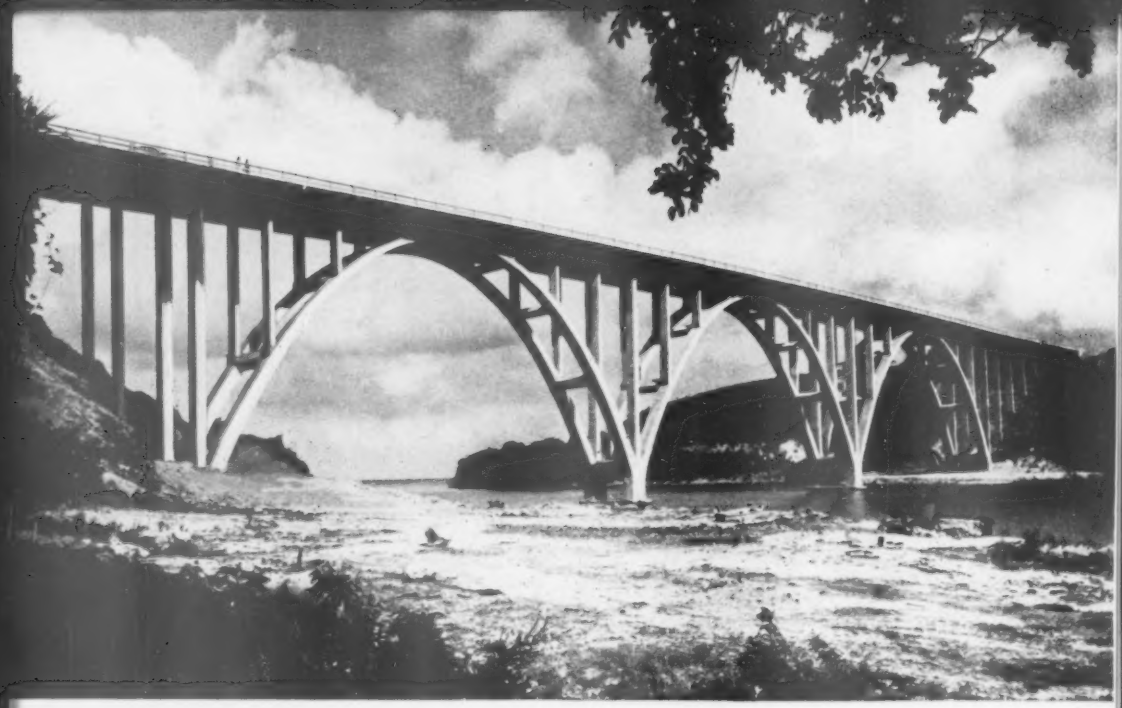
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4488 Wayne Avenue, Philadelphia 44, Penna.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS

First in Controls

● *Important Reference Data*

Write for your copy of Bulletin No. 85-20, "Centralized Instrumentation . . . unlimited."



Structure designed under direction of Ing. Jose Menendez of Comision de Fomento Nacional; Manuel Ray, Resident Engineer.

Raymond FORGES AN IMPORTANT LINK IN HAVANA-VARADERO HIGHWAY

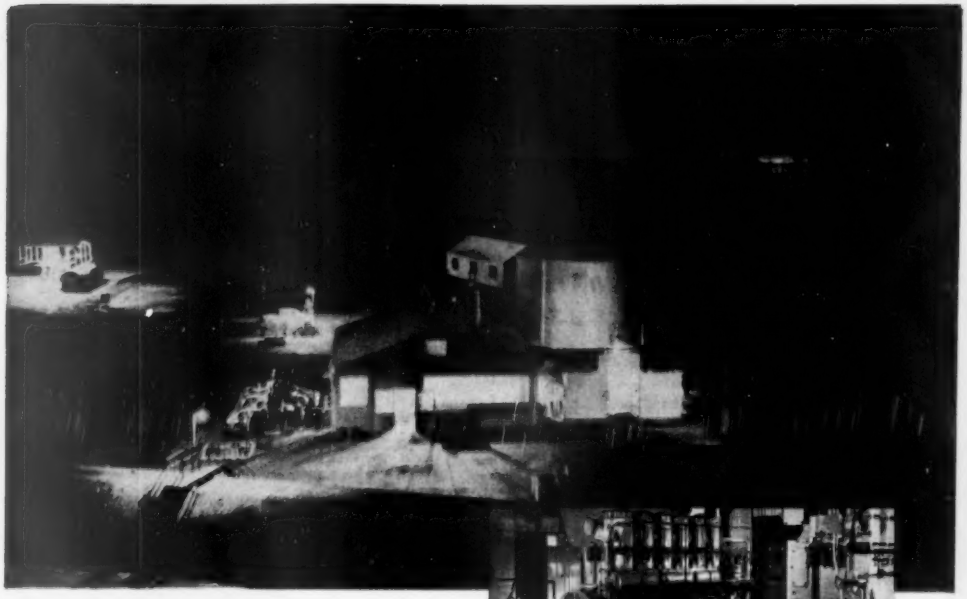
This graceful reinforced concrete bridge spanning the Canimar River in Cuba was completed by Raymond ahead of schedule. Hailed as one of the most functionally beautiful structures in the Caribbean, the three-span bridge is 115 feet high and has an overall length of 973 feet—a fitting symbol of the wide variety of Raymond activities.

Constructed for Cuban Comision de Fomento Nacional by Raymond Concrete Pile Company of South America

a wholly owned subsidiary of Raymond Concrete Pile Co.

Raymond
CONCRETE PILE CO.

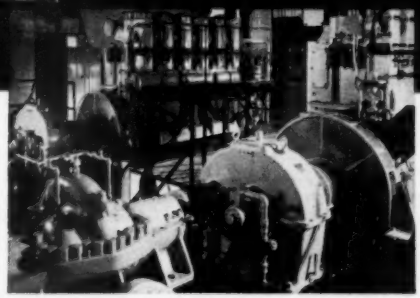
140 CEDAR STREET • NEW YORK 6, N. Y.



POWER—NIGHT OR DAY

ENTERPRISE Pipe Line Diesels cut tanker loading time and costs at Union Oil Ventura Pumping Station

Pumping crude from tanks to tankers calls for power that's ready when you need it—*night or day*. The intermittent use of power required for this fast moving operation demands *sure starting* and *continuous pumping* on *short notice*. The ability of these diesels to handle a fluctuating load increases pump efficiency and capacity. At Ventura, as with other similar ENTERPRISE installations, this means *more oil pumped faster* and shorter turn-around-time for the tankers. These important operating characteristics are not found in other pumping methods.



Two Enterprise DSG-6 Diesels, rated 465 HP at 450 RPM, furnish all the power for pumping an average 12,000 bbls. of crude per hour shore-to-ship, through 4,280 ft. of 20" cement coated line.

ECONOMY PLUS EFFICIENCY WITH ENTERPRISE DIESELS

- **Fuel flexibility**—Engines operate efficiently on standard diesel fuel, heavy fuel or dual-fuel.
- **Handle fluctuating loads** through a wide engine speed range for top pump efficiency regardless of viscosity changes.
- **Minimum plant investment**—more power in less floor space with compact ENTERPRISE power.
- **Low personnel requirements** for supervision, operation and maintenance.
- **Fully automatic operation**—wherever required or desired.
- **Remote location**—there are no power interruptions with ENTERPRISE Diesels.
- **Service and parts** are available within hours to the most remote locations.

Write for full details on the complete line of ENTERPRISE 4-cycle Diesel and Dual-Fuel engines, 68 to 2056 HP, turbocharged or normally aspirated.

Enterprise DEPENDABLE Diesels

ENTERPRISE ENGINE & MACHINERY CO.

A Subsidiary of General Metals Corporation

18th & FLORIDA STREETS, SAN FRANCISCO 10, CALIFORNIA

Boston • Chicago • Ft. Worth • Kansas City • Los Angeles • New Orleans
New York • San Diego • Seattle • St. Louis • Washington, D. C.

Announcing

THE IMPROVED STANDARD AXELSON LONG STROKE PUMPING UNIT

The profit producing advantages of the Axelson Hydraulic Long Stroke Unit are now intensified by improvements in design and construction. Now available to the petroleum operator, is the Improved Standard Model incorporating the following:

- Self-aligning, self-lubricating, spring loaded stuffing box eliminates the possibility of over tightening and burning the packing.
- Engineered fluid flow pattern in reverse valve mechanism provides minimum turbulence and reduces fluid friction losses.
- Unit is integral and requires no outside connections other than fuel lines.
- Base tripod is wider and higher, allowing a higher break out point and ample room for servicing well-head.
- Scavenger tank is integral with main base and has been appreciably increased in volume for storage capacity.
- Main control valve is actuated hydraulically through a centrally located control panel.
- "O" ring seals are used extensively to replace gaskets thereby assuring drip-proof joints in cylinder sections, etc.
- Where possible, welded and flanged pipe connections have replaced threaded joints in pressure lines.
- Spherical tank of sufficient capacity has replaced the vertical fluid tank and eliminated the horizontal balance tank thus reducing foundation requirements and hence installation costs.
- Reversals at top and bottom are actuated hydraulically through a unitized pilot and reverse valve assembly, permitting stroke length adjustment at both ends of cycle.
- Shorter main drive belt centers, providing less drive h.p. loss.

An Axelson engineer is at your service for discussion of any specific pumping problem.

Axelson

PETROLEUM PUMPING EQUIPMENT

OUR 61st YEAR

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

CHOSEN FIRST...TO LAST!

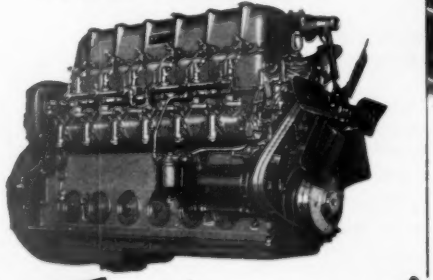
AXELSON MANUFACTURING CO. • 6160 SOUTH BOYLE AVENUE • P.O. BOX NO. 15335, LOS ANGELES 58, CALIFORNIA

P&H Diesel Engines

(2-CYCLE)

Are your diesels this easy to service?

P&H Diesel Engines are built in 1, 2, 3, 4 and 6-cylinder models — from 20 to 138 h.p.



Talk about simplicity! It's hard to imagine an engine simpler than the P&H Diesel! If any service is needed, you work *only* with the part affected.

An injection pump, for example. Replace it separately — in a few minutes. You needn't replace the entire system. Or a scored cylinder: No need to take down the whole engine. A complete new cylinder head and liner assembly can be installed in 40 minutes. And if need be, you can take it from any other P&H Diesel. Think of the convenience. And the time saving!

And by the way: P&H's precision aluminum alloy bearings, with more generous bearing surfaces, have practically eliminated connecting rod bearing troubles.

Your nearest P&H Diesel representative can give you all the reasons why wise users are standardizing on this advanced line of Diesel engines. Or write us.

P&H DIESEL DIVISION
HARNISCHFEGER CORPORATION
CRYSTAL LAKE, ILLINOIS

the P&H *Line*

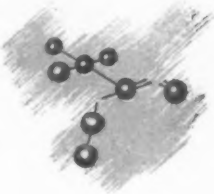
...two reliable names along the path of petroleum processing

WHAT DO YOU WANT TO PURIFY?

There's an Attapulgus or Porocel adsorbent to fit your process technique for removing odors, colors, tastes, moisture, acids, sulfur, fluorides and unsaturates from process liquids or gases. Materials treated in principal applications are: motor oils and other lubricating, specialty, and technical oils; petrolatums and waxes; aviation and motor gasoline stocks; kerosene; diesel and heating oils.

DO YOU HAVE CATALYST OR CATALYST CARRIER NEEDS?

Attapulgus or Porocel sorptive minerals are recognized standards in desulfurization, reforming and isomerization systems—catalytic removal of unsaturates—conversion of sulfides to elemental sulfur—fluid catalyst applications—as catalyst carrier in copper sweetening processes.



WHAT DO YOU WANT TO DRY?

We offer a wide range of reliable, thoroughly proved desiccants for drying air, hydrogen, carbon dioxide, hydrocarbon liquids and gases.

SPECIAL GRADES?

Mine and plant facilities permit prompt and economical production of grades meeting individual customer specifications. Our laboratories and technical staffs welcome the opportunity of assisting in research, development, design and operating problems. Your inquiries are invited.

ATTAPULGUS CLAY COMPANY *Fullers Earth* · **POROCEL CORPORATION** *Activated Bauxites*

Dept. V, 210 West Washington Square, Philadelphia 5, Pa.

TRACTION You can trust

4-wheel drive PAYLOADER®

It takes traction in all kinds of going to get jobs done on schedule — traction you can rely on the year 'round . . . pneumatic tire traction that can travel on highways as well as on ground, snow, sand and mud . . . that handles big loads quickly, easily and surely.

Yes, contractors, drillers and oil companies are amazed at the all-around traction of this unusual 1½ yd. tractor-shovel and its ability to do so many jobs well. It digs slush pits, builds fire walls, maintains roads, bulldozes, loads dirt and materials, grades drilling sites. It does crane work, carries tools and supplies . . . does drawbar and pushing work.

Operators like its ease of operation, thanks to power-boosted steering, fingertip hydraulic control, the quick, easy shift between the four forward speeds and four reverse speeds. Once you see the Model HM "PAYLOADER" in action you'll want one too, so see your "PAYLOADER" Distributor or write The Frank G. Hough Co., 749 Sunnyside Avenue, Libertyville, Illinois.

WRITE for catalog on the 1½ yd. Model HM or the six other "PAYLOADER" sizes down to 12 cu. ft. bucket capacity.

PAYLOADER®

How can you benefit

from these 34 major pipelines?

How? By applying to your future operations the electrical features developed for these 34 major oil and gas lines. Westinghouse is the source for this information.

Centralized automatic control

For example, in one new Westinghouse-equipped pumping station, centralized automatic control has been applied. The mere pressing of three buttons by a single employee, performs twelve operations in six minutes, that would normally take two or three men an hour. The savings in manpower and increase in revenue through fast starting are tremendous. And there's no chance of damage through opening valves in the wrong order.

Highly flexible and reliable operation

Electrical control has been developed that makes it easier to maintain operating schedules. With such control, all pumping stations can be more easily operated in step. This eliminates the need for storing successive pumpings in balance tanks with the resultant interbatch contamination.

Advancements in Power Systems

Westinghouse has made major advancements in Power Systems for pumping stations. All high-voltage equipment can be enclosed in metal-clad switchgear. This saves installation dollars, makes maintenance more convenient, and provides the ultimate in safety to personnel. The low-voltage circuit breakers and motor controls are centralized in compact Control Centers.

Call Westinghouse early when you plan

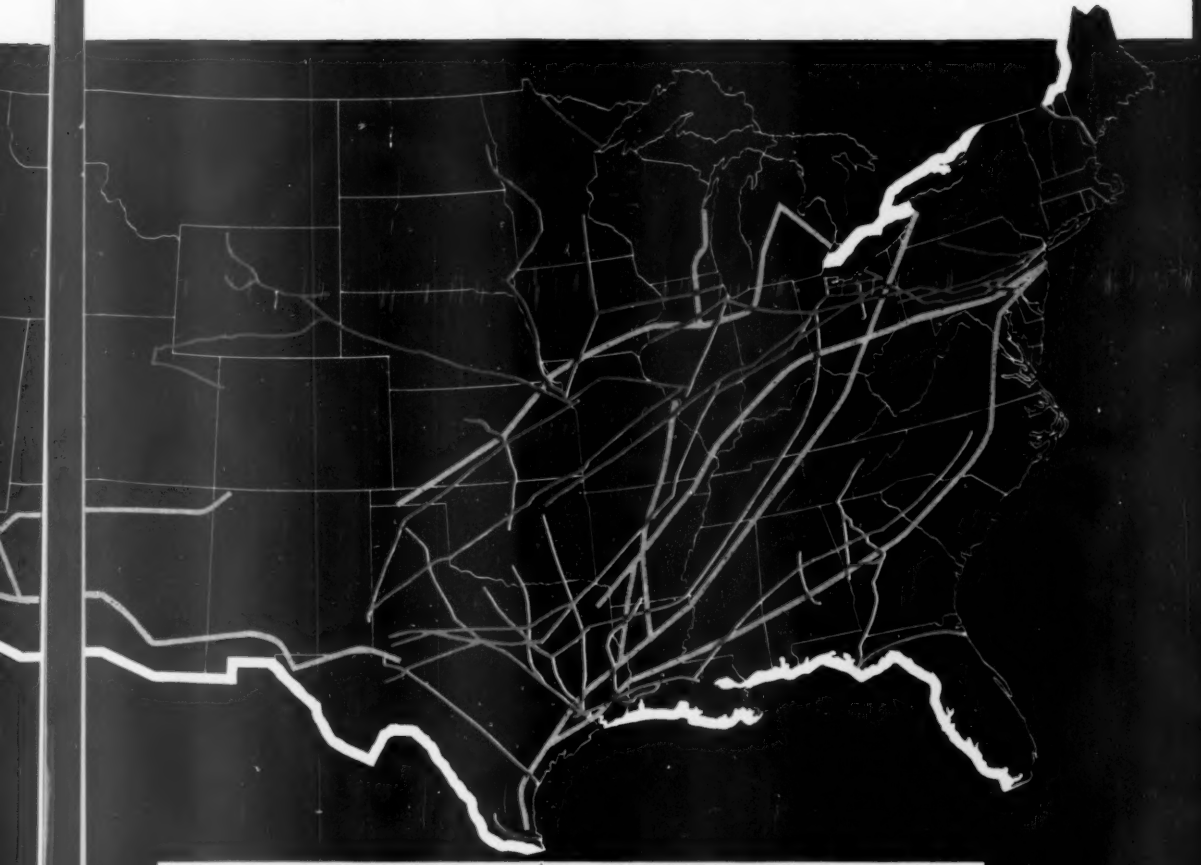
The experience gained in equipping these 34 lines is invaluable. Interest in remotely operated and automatic pumping stations is increasing and it's interesting to note that 20 years ago Westinghouse equipped the first pipeline pumping station for remote supervisory control. And Westinghouse Engineers are continually working on new developments to minimize the cost of pump station attendance. When your next job comes up, call Westinghouse early in the planning stage. Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Penna. J-94883

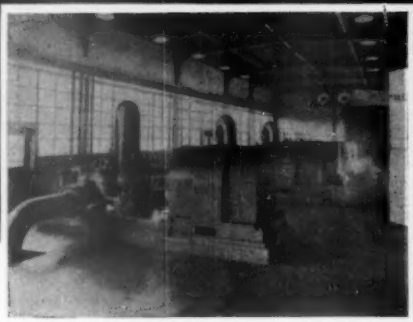
KEY
NATURAL GAS PIPELINES
CRUDE OIL AND PRODUCTS LINES
These 34 major pipelines equipped in whole or in part with Westinghouse equipment

YOU CAN BE SURE.. IF IT'S

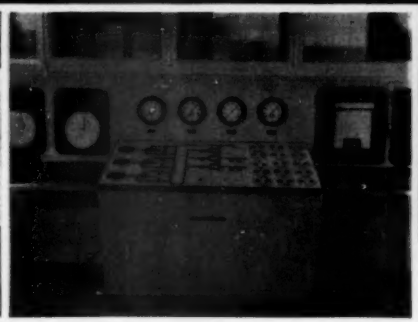
Westinghouse

EQUIPMENT FOR THE PETROLEUM INDUSTRY





A group of 1,250-horsepower forced-ventilation motors installed in a pumping station of a large crude oil pipeline. All units, including the suction and discharge valves and the ventilation blowers, are remotely operated by a sequence control system.



Pressing buttons on this control desk starts the main pumps and operates valves. Indicating lights show valve position. Other lights identify the operation of protective devices which warn of abnormal conditions. Buttons at right control booster pumps.

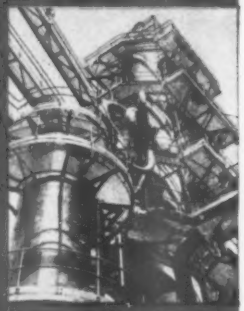
Specify KLEMP

✓ Grating and Stair Treads for Greater Safety

✓ Ganister Lining Reinforcement Meshes for Longer Life

(Above) Thousands of square feet of KLEMP HEXTEEL installed in World's Biggest Catalytic Cracker Unit at this Giant Gulf Oil Refinery in Port Arthur, Texas.

(Below) DIAMOND RIVETED GRATING serves for strong, clean, non-slip, fireproof, ventilated catwalks, mezzanines, stairways and platforms, prefabricated to your most exacting specification. Shown here is a Shell Oil Company installation.



(Above) GANISTER LINING REINFORCED with KLEMP HEXTEEL shown being welded into a cat cracker) keeps CATALYST REGENERATORS ON LINE Longer. HEXTEEL, when applied, as a reinforcement mesh is filled with a cement filler. This reduces "burn-arounds" to a minimum and helps avoid scouring and abrasive actions of the catalyst which can quickly ruin cat crackers and thermal crackers.

We Tread The World with Safety

The Klemp Metal Grating Corporation has been serving the needs of the Oil Companies for almost Half A Century. During this time Klemp has produced and patented several specialized gratings, such as HEXTEEL® and FLOORSTEEL® reinforcement meshes for use in fractionating vessels for the Oil, Chemical and Petro-Chemical industries.

KLEMP DIAMOND RIVETED and KLEMP KREST WELDED GRATINGS are consistently specified for stair treads, walkways, landings, tower stairs, catwalks, stairways and many other applications.

We are the only grating company to do all of our own work and we have complete fabricating facilities from complicated radial "set-ups", down to simple runs. Our engineers have spent a lifetime in this business and their specialized experience is at your service. We solicit the opportunity to solve your most difficult grating problems.

(Below) NEW KLEMP KREST* WELDED GRATINGS are made from special steel bars so formed to provide a peak or krest on the top side of the bar which gives this type of grating maximum non-slip characteristics. Ideal for structural foot walks as well as all other universal uses.

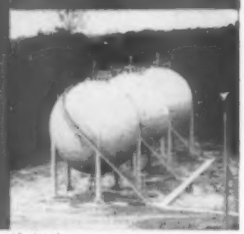
(Above) KLEMP FLOORSTEEL, because of its greater flexibility, is used to line the pipes leading to and from the catalyst regenerator. FLOORSTEEL is ideal for silencer stack units and also protects the narrow throat of the catalyst regenerator.

Write for Klemp's two new, free, fully illustrated technical catalogs, titled—

KLEMP 4 "Grates" serving the Nation's Major Oil Companies

KLEMP Open Steel Grating And Stair Treads

(Below) Klemp Manufactures Diamond Riveted, Welded and Serrated Stair Treads. This Serrated Tread has been developed especially for installations where unusual precautions are necessary to avoid accidents resulting from grease, mud, snow, etc.



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KLEMP METAL GRATING CORPORATION

For 15 Years... Reducing Oil Well Pumping Costs

VICKERS *Long Stroke*
HYDRAULIC PUMPING UNITS

Since the first installation in 1937, Vickers Hydraulic Pumping Units have been cutting the cost of lifting crude oil. Cost reduction is accomplished by marked improvement in subsurface efficiency, reduced well maintenance, practical elimination of rod breakage and, where desirable, a substantial increase in production.

(This original unit is still operating efficiently 24 hours per day after 15 years on the same well.)

Unitized design eliminates costly foundations and makes it unnecessary to disconnect any hydraulic piping to service the well. Among the other Vickers advantages are:

- *20 and 30 ft. stroke with maximum polished rod speed at minimum strokes per minute. (7 and 6 s.p.m. respectively)*
- *fewer reversals*
- *lower range of rod stress*
- *smooth shockless reversals*
- *lower standing valve velocities*
- *more safety features*
- *lower power requirement*
- *easier to operate*

Vickers Hydraulic Pumping Units were the first to feature unitized construction, long stroke, and pneumatic counterbalance. Vickers Units operate day in and day out, year after year with minimum maintenance.

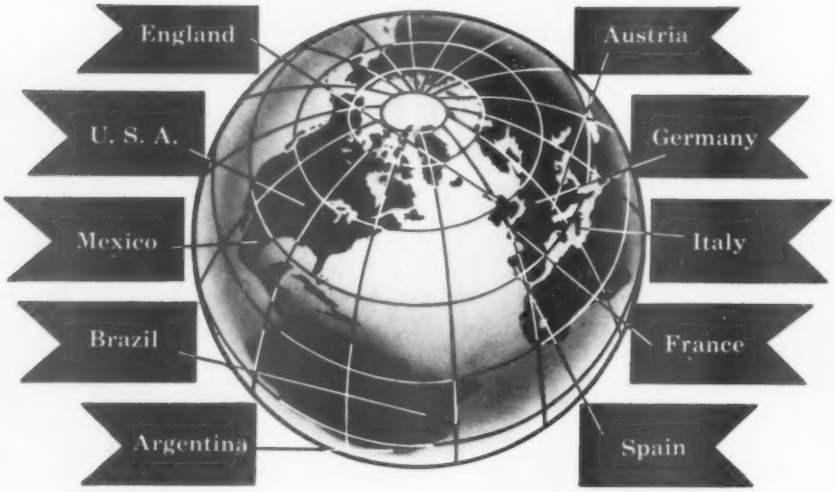
Using standard hydraulic oil as the working fluid, they are self-lubricated and totally enclosed . . . have automatic overload protection.

VICKERS Incorporated
Division of the Sperry Corporation
Petroleum Equipment Department
2160 EAST IMPERIAL HIGHWAY • EL SEGUNDO, CALIF.
Engineers and Builders of Oil Hydraulic Equipment Since 1921

Write for New Bulletin No. 52-51.

6041

WORTHINGTON products manufactured in these countries...



...can be bought in the CORRESPONDING LOCAL CURRENCY

In the countries shown on that globe, Worthington plants manufacture many hundreds of Worthington products. This means that you can obtain Worthington-engineered equipment built to Worthington-U.S.A. standards in the local currency of any one of these countries. Write for complete information on Worthington facilities around the world. Ask for Bulletin WP-1099-B54, Worthington Corporation, Export Department, Harrison, N. J., U.S.A.

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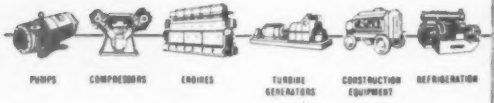


WORTHINGTON

The Sign of Value Around the World

Stop Costly Shutdowns Due To Valve Stem Failure

"Stemalloy"*

Outlasts The Next Best Stem Material

3 TO 1

Lunkenheimer "Stemalloy" Valve Stems, endurance tested under actual steam-pressure and service conditions, consistently outlasted the next best stem material 3 to 1. If you want to eliminate stem failure, insist on Lunkenheimer Valves. All Lunkenheimer Bronze Valves and Iron Body Bronze Mounted Valves have "Stemalloy" stems. Of the millions in service, *not one has ever been returned due to wear failure.*

WRITE FOR "Lunkenheimer Copper Base Alloys," a useful booklet on valve metals which will help you select the right valve for a given application. It is available from your distributor, or from The Lunkenheimer Company, Box 360F, Cincinnati 14, Ohio.

Fig. 73

*Patented alloy

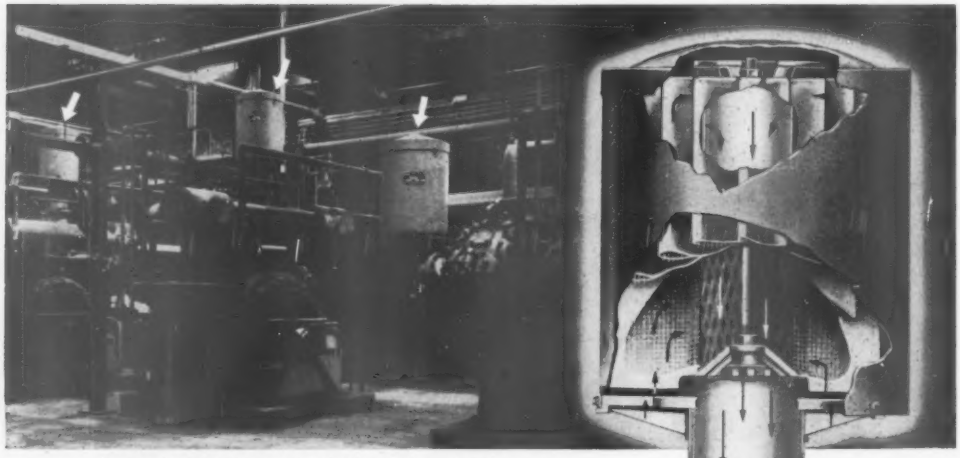
BRONZE • IRON • STEEL

LUNKENHEIMER

THE ONE *Great* NAME IN VALVES

L-652-7

STAYNEW INTAKE FILTERS



Staynew Intake Air Filters at Detroit Edison Company, Detroit, Michigan protect the vital parts of these Worthington Compressors.

MODEL D Intake Filter

KEEP COMPRESSORS YOUNG!

Your air compressing equipment demands the protection Staynew Intake Filters are designed to give. With Staynew, compressors, and internal combustion engines, blowers, motors and generators remain at peak efficiency years longer.

Staynew's "Positive Protection" keeps shutdowns and repairs at an absolute minimum. And Staynew itself requires less attention. The *dry-type* filtering medium has the ability to remove air-borne dust particles without the necessity of viscous filter aids.

Staynew Intake Filters efficiently protect vital engine parts without carefully held maintenance schedules. And where noise is a problem, Model DS Silencer Filters are available. To keep equipment young, always specify Staynew.

Write today for Staynew Catalog S.I.F.

- Positive Protection
- Efficiency Actually Increases with Use
- Efficient Over a Wide Range of Loads
- Not Affected by Temperature Changes
- No Oil Carry-Over
- No Oil Blow-Out Over Free Air-Unloading Compressors

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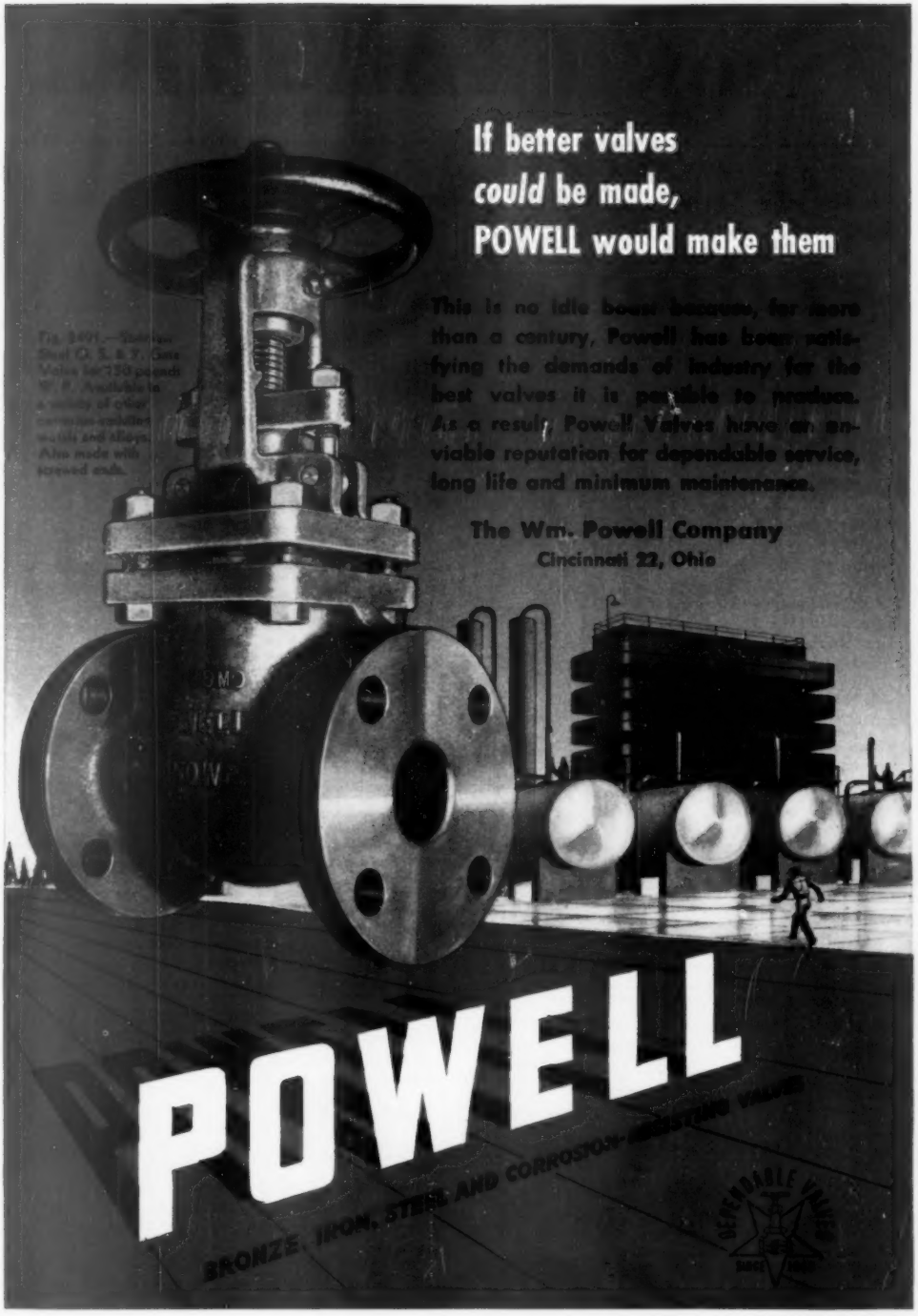
DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

DOLLINGER CORPORATION

5 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED


If better valves
could be made,
POWELL would make them
This is no idle boast because, for more than a century, Powell has been satisfying the demands of industry for the best valves it is possible to produce. As a result, Powell Valves have an enviable reputation for dependable service, long life and minimum maintenance.
The Wm. Powell Company
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POWELL
BRONZE, IRON, STEEL AND CORROSION-RESISTING VALVES

New TRANSAIRE®

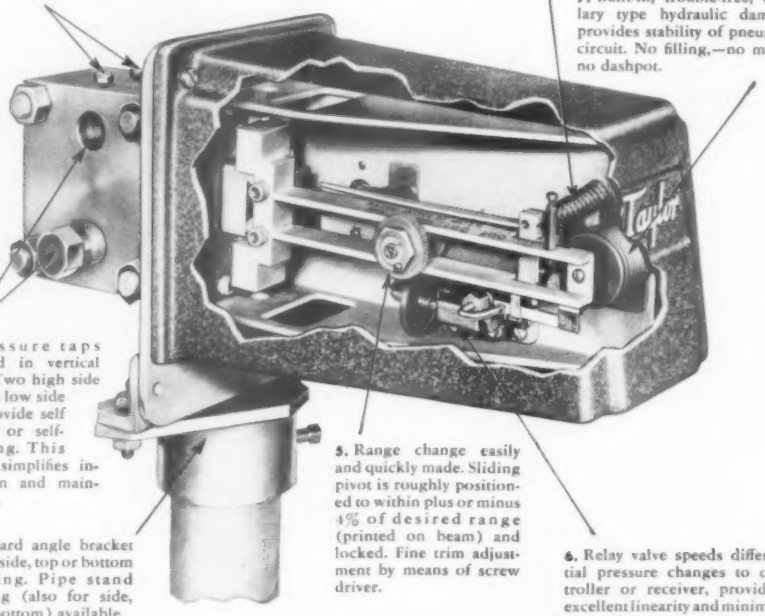
The new Taylor TRANSAIRE® Differential Pressure Transmitter

1. Dry meter operates on force-balance principle. Diaphragm of Teflon coated glass cloth. Body working pressure rating 1500 psi. Available in either forged steel or type 430 stainless steel.

2. Vent screws to provide for total filling in liquid service.

8. Provision for adjustment of range suppression up to 100%.

7. Built-in, trouble-free, capillary type hydraulic damping provides stability of pneumatic circuit. No filling,—no mess—no dashpot.

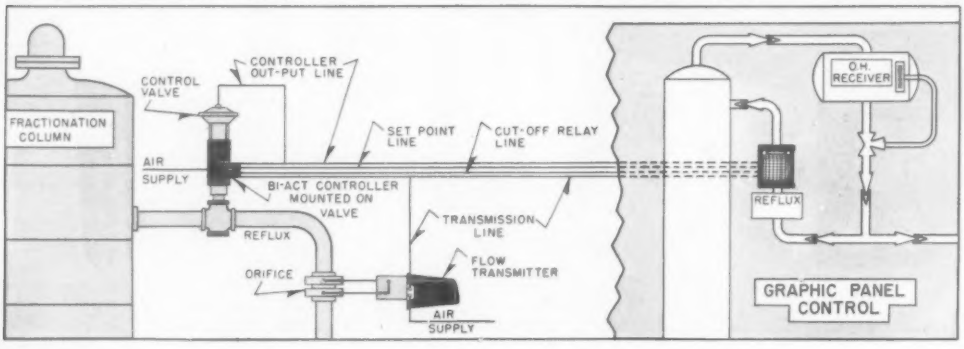


3. Pressure taps mounted in vertical plane. Two high side and two low side taps provide self venting or self-draining. This feature simplifies installation and maintenance.

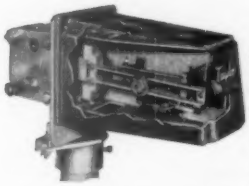
4. Standard angle bracket permits side, top or bottom mounting. Pipe stand mounting (also for side, top or bottom) available.

5. Range change easily and quickly made. Sliding pivot is roughly positioned to within plus or minus 4% of desired range (printed on beam) and locked. Fine trim adjustment by means of screw driver.

6. Relay valve speeds differential pressure changes to controller or receiver, providing excellent linearity and minimum hysteresis.



Flow Transmitter widens selection of Taylor Transmitters!



THIS new Taylor Transmitter is the result of extensive field study and close collaboration with users of force-balance transmitters. It is designed to meet present day industrial requirements for a rugged, dependable and accurate instrument to measure flow, liquid level or specific gravity. With this new development three force-balance transmitters are now available for the measurement and transmission of flow, temperature and pressure.

INEXPENSIVE AND SIMPLE TO INSTALL

• Simplified piping because it can be close coupled to orifice flanges. • No seal pots required—negligible displacement because of force-balance construction. • No leveling—mercuryless dry meter. • Light weight for easy handling; weighs only 23 lbs.

ECONOMICAL, EASY TO MAINTAIN

• Self draining or venting—no periodic manual venting or draining. • Overrange protection to full body rating.

ACCURATE

• Relay valve for linearity, minimum hysteresis, fast speed of response. • Pressure effect 0.2% / 100 psi. change. • Temperature effect 1.0% / 100°F. change.

RUGGED AND DEPENDABLE

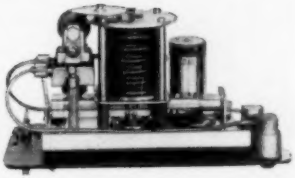
• Weatherproof housing built for tough service and outdoor mounting. • Force-balance construction; negligible motion; minimum possible wear. • Process sealing bellows 3 ply type 316 stainless steel.

▼ ▼ ▼

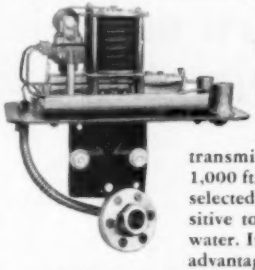
Ask your Taylor Field Engineer for full details of this new Taylor TRANSAIRE Differential Pressure Transmitter, or write for **Bulletin 98226.** Taylor Instrument Companies, Rochester, N.Y., and Toronto, Canada.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

TAYLOR TRANSAIRE TEMPERATURE TRANSMITTER



With Speed-Act. This is a compact, super-responsive instrument designed to measure and transmit smallest temperature changes up to 1000 ft. with great accuracy. It gives you: • Unprecedented speed of response provides dynamic accuracy thanks to derivative action (Speed-Act) in the *measuring* circuit. • It will transmit an output pressure proportional to the measured temperature with an accuracy of plus or minus 0.06 psi.



TAYLOR TRANSAIRE PRESSURE TRANSMITTER

A highly sensitive and accurate suppressed pressure measuring instrument, designed to measure and transmit pressure changes up to 1,000 ft. It is accurate to ½% of the selected short range span and sensitive to pressure changes of ½" water. It gives you these important advantages: • Short range spans available 20 to 40 psi. throughout range limits of 35 to 415 psia, and 50 to 100 psi. throughout 100 to 1,000 psia. • Volumetric type pressure system is extremely accurate, practically clog-proof, has corrosion resistant 316 stainless steel diaphragm. • Temperature and barometric compensation for higher accuracy of measurement and control.

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

MILE AFTER MILE

You'll Get Better Performance with PITT CHEM Plasticized Enamel

Pipeline crews can tell you the advantages of applying Pitt Chem Plasticized Grade Enamel at any temperature from —20° F to 160° F. For mile-after-mile, ton-after-ton, they get the *same* excellent application characteristics because of the uniform high quality of Pitt Chem Plasticized Enamel.

As a *basic producer* of tar base pipeline enamels, we control every step of production from coal to finished product . . . in a plant devoted *exclusively* to the production of coal tar coatings. What's more, we back up the unvarying quality and dependability of supply with on-the-spot field service whenever you need it. ● *Additional information on Pitt Chem Plasticized, Modified, or Standard Tar Base Enamels is yours for the asking.*

★ Standard Grade Tar Base Enamel
★ Modified Grade Tar Base Enamel
★ Plasticized Grade Tar Base Enamel
★ Cold Applied Tar Base Coatings
★ Synthetic Protective Coatings

PROTECTIVE COATINGS DIVISION

PITTSBURGH COKE & CHEMICAL CO.

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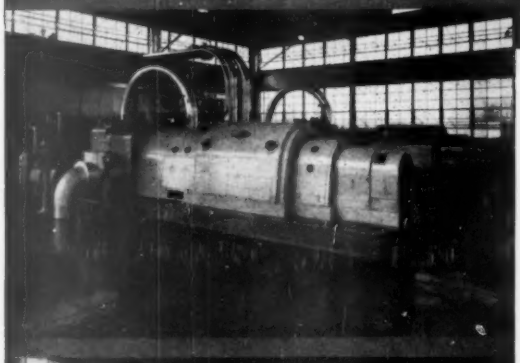
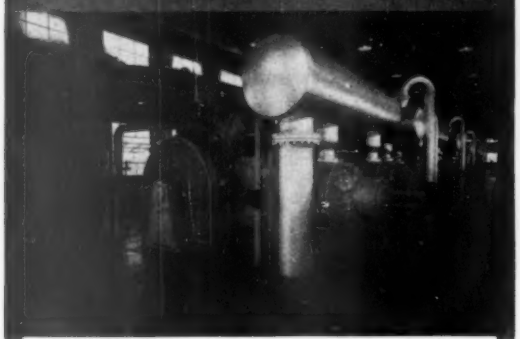
WBD 3954

COAL CHEMICALS • AGRICULTURAL CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

For BETTER, EASIER housekeeping

with *Maximum Safety*





THESE FLOORS ARE KEPT CLEAN AND SAFE BY THE MULTI-CLEAN METHOD

A noticeable characteristic of plants like the above is the immaculately kept floors and all around good housekeeping. These beautiful floors are typical examples of what the Multi-Clean Method is accomplishing in plants of the Petroleum Industry all over the country. Their luxurious finish, obtained through application of Multi-Clean approved floor liquids, is non-slip, making floors safe to walk on and work upon. This finer floor care improves working conditions, stimulates employe morale and is a distinct public relations asset.

The use of the Multi-Clean Explosion Proof Floor Machine is providing mechanical floor maintenance in many plants without the danger of fire and explosion. It is used with absolute safety for buffing, cleaning and polishing all floors, whether concrete, terrazzo, asphalt tile, rubber tile, wood or linoleum.

MULTI-CLEAN®
PRODUCTS, INC.

2277 Ford Parkway St. Paul 1, Minn.

MULTI-CLEAN®
PRODUCTS, INC.

EXPLOSION PROOF FLOOR MACHINE and THE MULTI-CLEAN METHOD

Safety and efficiency are combined in this machine . . . explosion proof motor and other essential safety features permit mechanical floor cleaning and maintenance in hazardous areas without danger of fire or explosion.

All electrical components approved by Underwriters Laboratory.

SAVES TIME AND LABOR ASSURES UTMOST SAFETY

The Multi-Clean Explosion Proof Floor Machine gets better results faster . . . more safely. Man hours required are reduced over slow and expensive hand labor by cleaning with the one-man machine method. Floors are made safer by the thorough cleaning action which removes all accumulations of grease, chemicals, or other dangerous materials. And the Multi-Clean Method beautifies floors, makes them longer-lasting, protects them against wear and corrosion.

Mail **COUPON TODAY!**

Multi-Clean Products Inc.
2277 Ford Parkway, Dept. OG-12, St. Paul 1, Minnesota

Gentlemen: Please send me further information on the Multi-Clean Explosion Proof Floor Machine and the Multi-Clean Method.

NAME_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

CONTINENTAL'S Line is Complete

CONTINENTAL MOTORS
Powerful as the Nation
AMERICA'S STANDARD

INDUSTRIAL GASOLINE ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
N56	4	2¼	3½	56	14.2 @ 2200 RPM
N62	4	2⅜	3½	62	15 @ 2200 RPM
Y69	4	2½	3½	69	21.4 @ 2400 RPM
Y91	4	2⅞	3½	91	28.5 @ 2400 RPM
Y112	4	3⅛	3½	112	32 @ 2400 RPM
F124	4	3	4½	124	36 @ 2400 RPM
F140	4	3⅛	4½	140	42 @ 2400 RPM
F162	4	3⅞	4½	162	49 @ 2400 RPM
F186	6	3	4½	186	60.5 @ 2400 RPM
F209	6	3⅛	4½	209	68 @ 2400 RPM
F226	6	3⅜	4½	226	73 @ 2400 RPM
F244	6	3⅞	4½	244	79 @ 2400 RPM
M271	6	3½	4½	271	86.2 @ 2400 RPM
M290	6	3⅝	4½	290	92.2 @ 2400 RPM
M330	6	4	4½	330	104.4 @ 2400 RPM
B371	6	4⅛	4½	371	110 @ 2400 RPM
B427	6	4⅜	4½	427	127 @ 2400 RPM
G134	4	3½	4½	134	32.2 @ 2000 RPM
G157	4	3⅝	4½	157	37.7 @ 2000 RPM
H227	4	3½	5½	227	54 @ 2000 RPM
H243	4	3¾	5½	243	58.2 @ 2000 RPM
*H260	4	3⅞	5½	260	62 @ 2000 RPM
T371	6	4⅛	4½	371	119 @ 2400 RPM
T427	6	4⅜	4½	427	140 @ 2400 RPM
U501	6	4½	5¼	501	160 @ 2400 RPM
R513	6	4½	5½	513	164.3 @ 2400 RPM
R572	6	4½	5½	572	182.4 @ 2400 RPM
R602	6	4⅝	5½	602	191.7 @ 2400 RPM
S749	6	5½	5½	749	217 @ 2200 RPM

INDUSTRIAL DIESEL ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
GD157	4	3½	4½	157	39 @ 2000 RPM
HD243	4	3¾	5½	243	54.7 @ 2000 RPM
*HD260	4	3⅞	5½	260	59.3 @ 2000 RPM
TD427	6	4⅜	4½	427	106.5 @ 2000 RPM
RD572	6	4½	5½	572	142.5 @ 2000 RPM
SD802	6	5⅝	5½	802	184.3 @ 1800 RPM

*Available for Industrial applications only.

35 INDUSTRIAL MODELS

14 to 217 Horsepower Assure the RIGHT Engine for Every Oil Field Job

One good reason for choosing Continental oil field power is the exceptional completeness of the Continental Red Seal line. The industrial series, for instance, comprises 35 different basic models, with an output range from 14.2 h.p. up to 217. Six of these are full Diesels with exclusive Continental Cushioned Power. Continental Red Seals—single or compounded—are getting the call for more and more types of oil field applications, in drilling, distributing and processing, by reason of this specialization—by reason of the fact that Continental builds exactly the right engine for the job.

... PARTS AND SERVICE EVERYWHERE

Continental Motors Corporation

MUSKEGON, MICHIGAN

6218 CEDAR SPRINGS ROAD, DALLAS 9, TEXAS • 3817 S. SANTA FE AVE., LOS ANGELES 58, CALIFORNIA

in WIRE ROPE, too, survival calls for the RIGHT KIND of muscle

Powerful, constrictive muscles give the python the crushing strength that enables him to exist under the grim rules of jungle law—where only the fittest survive.

Same way with wire rope. Here again, ability to last under adverse conditions demands the right kind of muscle. Bending Fatigue . . . Shock Stress . . . Abrasion . . . Load Strain—each demands wire rope that best combines the required resistance factors to overcome the destructive forces encountered in different types of service.

Complete quality control from ore to finished rope; long experience and specialized know-how — these are your assurance that in Wickwire Rope you always get the right construction . . . the right grade of steel and size of wire for long-lasting reliable service on your particular job.

See your Wickwire Rope distributor or contact our nearest sales office.

WICKWIRE ROPE
A CF&I PRODUCT

A YELLOW TRIANGLE ON THE REEL IDENTIFIES WICKWIRE ROPE

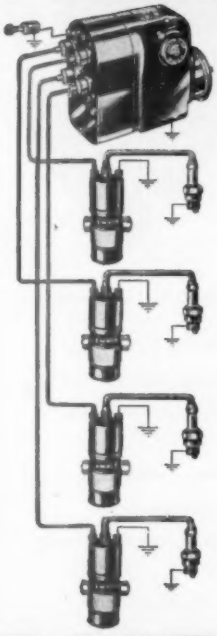
THE COLORADO FUEL AND IRON CORPORATION—Abilene (Tex.) • Denver • Houston • Odessa (Tex.) • Phoenix • Salt Lake City • Tulsa
THE CALIFORNIA WIRE CLOTH CORPORATION—Los Angeles • Oakland • Portland • San Francisco • Seattle • Spokane
WICKWIRE SPENCER STEEL DIVISION—Boston • Buffalo • Chattanooga • Chicago • Detroit • Emlenton (Pa.) • New York • Philadelphia

WICKWIRE ROPE

CF&I PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

5584

Land,
Swamp or
Off-Shore
RIGHT IN
OUR STRIDE
MARINE
EXPLORATION CO.
3732 WESTHEIMER ROAD, HOUSTON 6, TEXAS



for Large Bore, Stationary Gas Engines

AMERICAN BOSCH

LOW TENSION MAGNETO IGNITION SYSTEM

The System comprises the American Bosch MRB Low Tension, shielded Magneto and individual High Tension Ignition Transformers mounted at each engine cylinder. (See 4 cyl. installation diagram at left). Low tension current, generated in the Magneto, is distributed through low tension leads to the Transformers. Here, the electrical energy is stepped-up to high voltage and conducted to the spark plugs by short cables—shielded if desired. The rugged, heavy-duty, high tension Transformers (as illustrated above) are available with or without shielding for use in the American Bosch System or other low tension systems employing magneto or battery ignition.

Energy losses and corona effects which occur with long high tension cables are eliminated. The possibility of fire and explosion hazard is minimized where engines operate in combustible vapors . . . radio and TV interference may be greatly reduced by complete shielding. These important advantages, combined with the outstanding electrical and mechanical features of the American Bosch Low Tension Magneto, offer maximum spark efficiency for engines operating under severest conditions. Write for the facts and we'll show you how you can get this peak performance and safer, continuous service with your present equipment. American Bosch Corporation, Springfield 7, Mass.

AMERICAN BOSCH

This Simple Compressor Meets the Complex Needs of a Changing Petroleum Industry

It's the Nash!

Here is a compressor presenting advantages found in no other device. Nash Compressors have only one moving part, rotating without metallic contact with the pump casing. No internal lubrication is required. Yet they produce 75 lbs. pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure.

There are no valves, gears, pistons, sliding vanes, or other complicated wearing parts in a Nash. Compression is secured by an entirely different principle of operation. Because of this, gas pumping problems difficult with ordinary pumps are often easily handled by the Nash. For example, Nash Pumps are standard equipment in the Synthetic Rubber Industry, where they have met the needs of new and difficult processes.

Nash Compressors are compact and save space. They run without vibration, and compression is without pulsation. They maintain original performance over long periods. Service is assured by a nationwide net-work of Engineering Service offices. Instructive bulletin shows how they operate. Write for it.

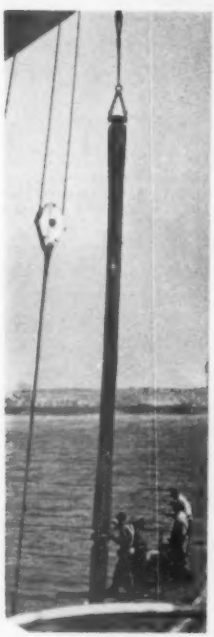
- One moving part.
- No internal wearing parts.
- No valves, pistons, or sliding vanes.
- No internal lubrication.
- Low maintenance.
- Slugs of liquid entering pump do no harm.
- Non-pulsating pressure.
- Saves floor space.
- 75 pounds in a single stage.

NASH ENGINEERING COMPANY
274 WILSON, SO. NORWALK, CONN.

Industrial rubber products especially built for LONG SERVICE

PIONEER

This Pioneer Hose is still young after *seven years* on the ocean bottom



Pioneer's Submarine Hose regularly spends seven to eight years on the ocean bottom at Richfield Oil Corporation's Elwood (Calif.) Terminal, and during that time conveys millions of barrels of gasoline from ship to shore. Even then, this hose is not ready for retirement. One used length was installed as an experiment at another Richfield Terminal, and it shows no signs of giving up today *after four years of extra duty!*

Pioneer Submarine Hose has been used at the Elwood Terminal since its opening in 1928. Eight lengths are attached to a pipeline extending almost 4,000 feet seaward. After a tanker is moored, the end of the hose is raised and pumping begins. Crude was originally pumped to the ships at 6,000 barrels an hour, but operations have recently been changed to the discharge of gasoline at about 4,000 barrels an hour. Seven and more years of service on such duty is truly remarkable.

Only an organization that knows *how* to build a good product, *and also has a policy of building it that way* can offer such exceptional service. Your nearest Pioneer representative will be glad to give you specific information on Pioneer products for *your* use.

PIONEER RUBBER MILLS

Pioneering in rubber since 1888

BRANCHES: CHICAGO • CLEVELAND
DALLAS • LOS ANGELES • MILWAUKEE
ST. LOUIS • SAN FRANCISCO

BELTING • INDUSTRIAL HOSE • FIRE HOSE
PACKINGS • RUBBER COVERINGS AND
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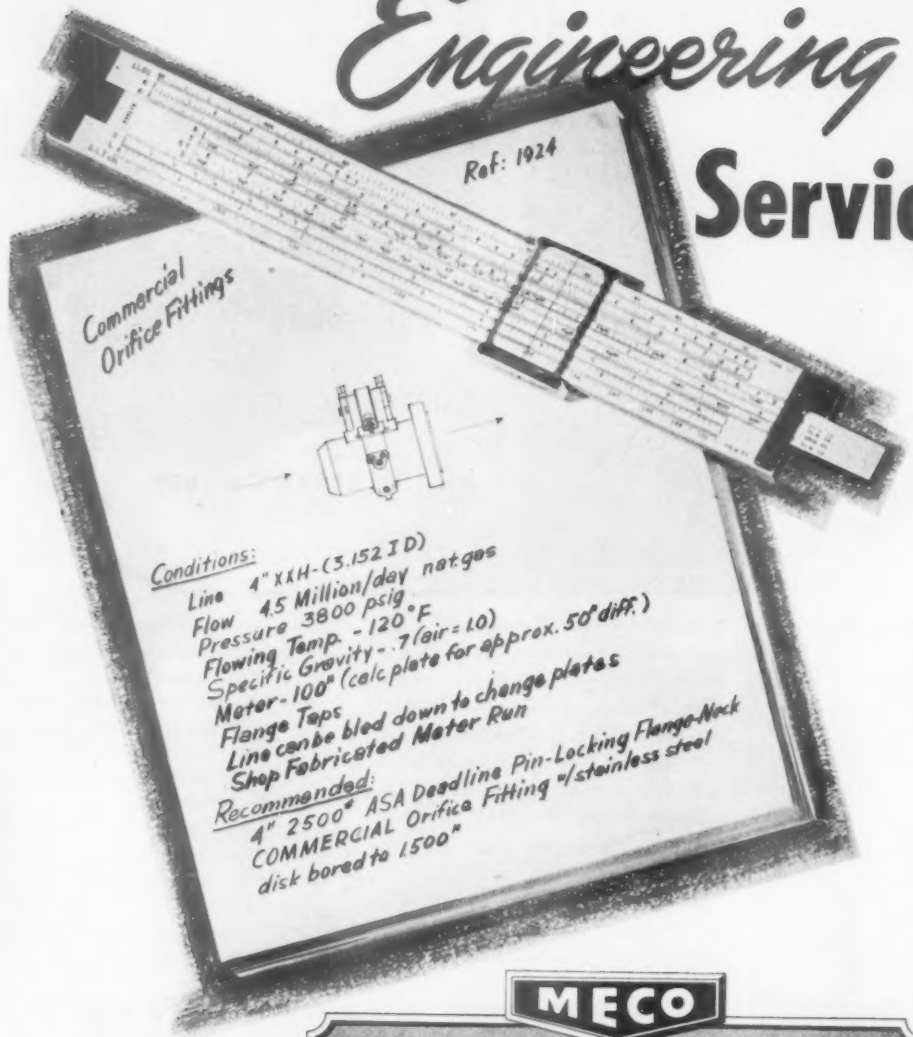
FACTORIES: PITTSBURG, CALIFORNIA • **MAIN OFFICE:** 345-353 SACRAMENTO STREET, SAN FRANCISCO 11, CALIF.

Distributors in other principal cities

Equipment with *Engineering* Service


Ref: 1924
Commercial Orifice Fittings
Conditions:
Line 4" XXH-(3.152 I D)
Flow 4.5 Million/day nat gas
Pressure 3800 psig
Flowing Temp. - 120°F
Specific Gravity - .7 (air = 1.0)
Meter - 100" (calc plate for approx. 50" diff.)
Flange Taps
Line can be bled down to change plates
Shop Fabricated Meter Run
Recommended:
4" 2500# ASA Deadline Pin-Locking Flange-Neck
COMMERCIAL Orifice Fitting w/stainless steel
disk bored to 1.500"

MECO

MAINTENANCE *Engineering* **CORPORATION**

P. O. BOX 2637

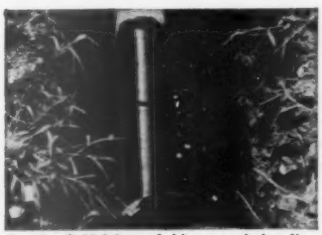
3711 CLINTON DRIVE
HOUSTON, TEXAS

NEW from Johns-Manville

TRANTEX *polyvinyl* TAPE

. . . a cold applied wrap that protects underground and overhead oil and gas lines from corrosion

Tough, corrosion-resistant Trantex Tape is used here to repair holidays in the line. Easily applied, it is an economical material for this service.



For the field joints of this transmission line, Trantex Tape is used to give these critical spots lasting protection against corrosion.

FOR more than fifty years Johns-Manville has been manufacturing pipeline protection material. This experience, plus the knowledge gained in the research laboratory and in the field about the effects of corrosion, have gone into the making of "Trantex"—a new plastic tape for extending the service life of oil and gas lines.

Trantex needs no special equipment in its application. It is easily applied by hand or hand-operated devices. A pressure-sensitive adhesive forms a tight bond with the pipe—shields it against the general corrosive conditions that cause most pipeline failures. Trantex has proved remarkably resistant to the effects of soil chemicals, acids, alkalies, alcohols, oil and grease, sunlight and aging.

Check the basic properties of Trantex in the table below—each one is extremely important in the control of corrosion.

For more detailed information about Trantex *polyvinyl* Tape, write to Johns-Manville, Box 60, New York 16, N. Y.; in Canada, 199 Bay Street, Toronto 1, Ont.

	*V-10	**V-20
Dielectric Strength per mil thickness, Approx.	1,000 V	1,000 V
Insulation Resistance, greater than (ASTM-D-257-49)	100,000 megohms	100,000 megohms
Operating Temperature	200 F	200 F
Adhesion	30 oz per inch	20 oz per inch
Tensile Strength	30 lbs per inch	56 lbs per inch
Elongation at Break	250%	300%

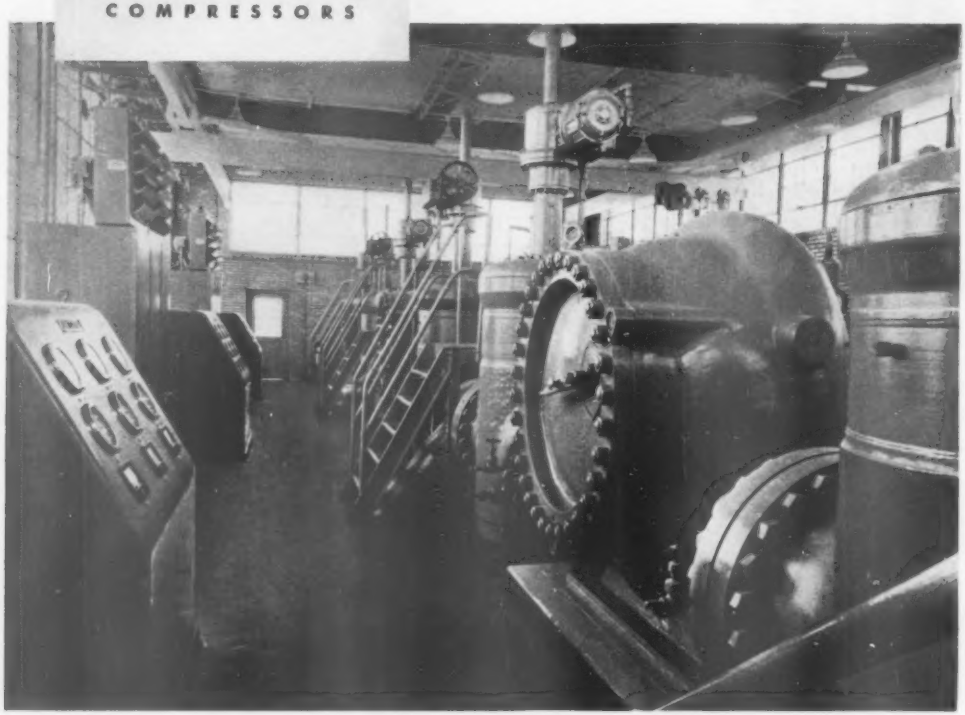
"Trantex" is a black polyvinyl tape. It is available in two thicknesses—
*V-10 is a 10 mil tape for general conditions, and
**V-20 is a 20 mil thickness for use where a more rugged coating is specified.

Johns-Manville TRANTEX *polyvinyl* TAPE

PROTECTS PIPELINES AGAINST CORROSION

DE LAVAL
CENTRIFUGAL
COMPRESSORS

on the job at Texas Eastern



The centrifugal compressors on Texas Eastern Transmission Corporation's new 30-inch gas pipeline from Kosciusko, Mississippi, to Uniontown, Pennsylvania, are all De Laval.

Thirteen De Laval compressors will be installed in stations at Barton, Alabama; Gladeville, Tennessee (shown above); and at Wheelersburg and Berne, Ohio. Each station will be equipped with three 2,500 horsepower motor-driven compressors, except Berne, which will have four.

One of the outstanding engineering features of these compressors is the effective use of inlet guide vanes. This De Laval feature provides greater operating flexibility than has been previously possible with constant speed motor-driven units.

Once again De Laval engineering has led the way in developing better centrifugal compressors for natural gas transmission. If you want to know more about the advantages of De Laval centrifugal compressors—consult our engineers. They will be glad to give you the benefit of our wide experience on the major gas pipelines using centrifugals.

DE LAVAL *Centrifugal Compressors*

DE LAVAL STEAM TURBINE COMPANY
810 Nottingham Way, Trenton 2, New Jersey

DL 161

WIZARD CONTROLLERS are available for integral mounting on diaphragm casing, or for remote control service which enables the unit to be mounted flush or on the surface of a panel, or mounted on the yoke of a control valve.

SERIES 4100 Pneumatic pressure controller with adjustable proportional band.

SERIES 4101 Pneumatic on-off pressure controller with adjustable differential gap.

SERIES 4102 Pneumatic pressure controller with non-bleed orifice and low pressure cut-off.

SERIES 4103 Low pressure Wizard, bellows actuated with differential gap.

SERIES 4104 Wizard controller with differential gap and non-bleed pilot.

SERIES 4105 Bellows actuated differential pressure controller.

SERIES 4106 Low pressure, bellows actuated, Wizard pressure controller.

FISHER

FISHER® WIZARD PRESSURE CONTROLLERS

Available in a variety of constructions for your particular requirements in the CHEMICAL PROCESS INDUSTRIES, GAS DISTRIBUTION, PIPE LINE TRANSMISSION, POWER PLANTS, REFINERIES, OIL PRODUCTION and GENERAL INDUSTRIAL APPLICATIONS.

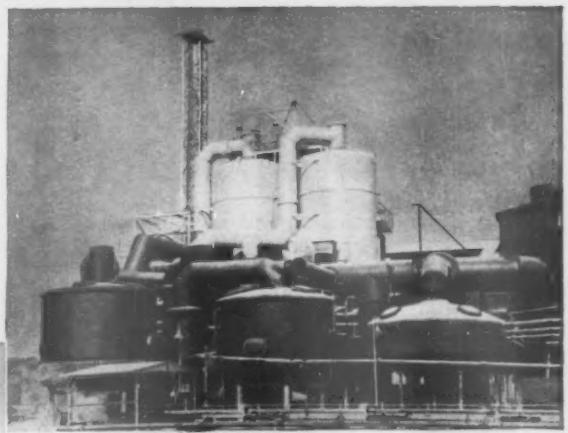
FISHER GOVERNOR COMPANY • Marshalltown, Iowa

WORLD LEADER IN THE MANUFACTURE OF LIQUID LEVEL CONTROLLERS, PRESSURE REGULATORS AND IN RESEARCH FOR BETTER CONTROL

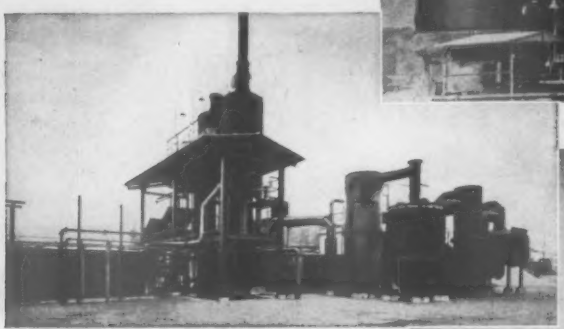
How much sulfuric acid do you need?

Among the many Chemico-built contact sulfuric acid plants in service today all over the world, one has a capacity of only five tons per day. Another produces more than five hundred tons per day. Others range in between.

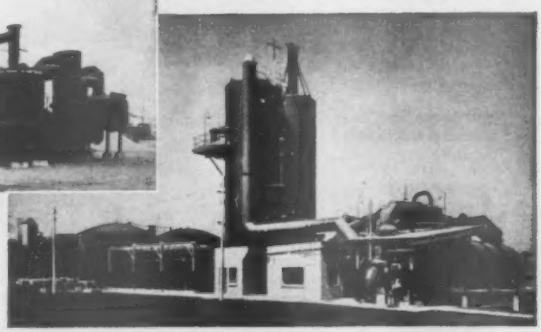
Whatever your sulfuric acid requirements are, Chemico will design and furnish you with a highly efficient plant exactly suited to your needs . . . on a one-contract, guaranteed-performance basis.



500 Tons



50 Tons



200 Tons

CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

488 MADISON AVENUE, NEW YORK 22, N. Y.

CABLES: CHEMICONST, NEW YORK

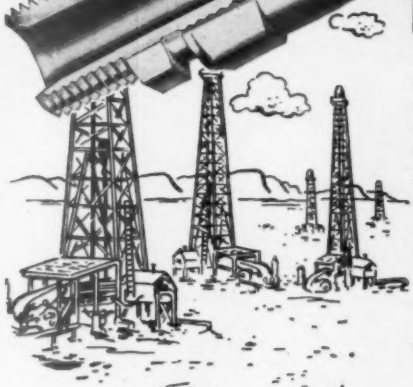
TECHNICAL REPRESENTATIVES: CYANAMID PRODUCTS LTD., LONDON • CHEMICAL CONSTRUCTION (INTER-AMERICAN) LTD., TORONTO • SOUTH AFRICAN CYANAMID (PTY) LTD., JOHANNESBURG

Chemico plants are profitable investments

Make Oil-Field Hose Assembly Easier, Faster, Safer

ANC HOR

. . . use Anchor Reusable Couplings with exclusive, patented features



Oil-field equipment manufacturers like Anchor two-piece reusable couplings. Oil-field equipment users like them, also, because you get more for your money with Anchor. You get an exclusive, patented design that saves you time and trouble — a grip that's safer, more dependable. Look at these advantages:

- **Assembly is easy and fast.** All you need is an oil can, a wrench, and a vise. It's that simple!
- **No expensive inventory** of prefabricated hose assemblies. Simply carry one coil in the sizes you use. Cut it to the lengths you need.
- **Anchor's exclusive patented grip** keeps hose assemblies on the job day-in and day-out — prevents leaks and dangerous blow-offs. Couplings can be used over and over again.
- **Downtime reduced.** One of your greatest expenses is cut — costly downtime in the field. Servicing can be performed immediately *without special tools.*
- **Streamlined coupling design** makes possible neat, efficient installations, even in confined spaces.

Anchor makes the most complete line of hydraulic hose assemblies and fittings available. That's why you can select the hose assembly that fits your needs — a hose assembly that lasts longer, performs better, handles easier. For best results, let Anchor go to work for *you.* Send coupon for additional information.

Attach coupon to your letterhead and mail today!

ANCHOR COUPLING CO. Inc.
FACTORY: Libertyville, Ill. ● BRANCHES: Detroit, Mich., Dallas, Tex.

ANCHOR COUPLING CO. INC.
Dept. OG-122, Libertyville, Illinois

Yes, I'm interested in Anchor 2-piece reusable couplings. Send me more information.

NAME..... TITLE.....
COMPANY NAME .....
COMPANY ADDRESS .....
CITY ..... (. . .) STATE.....

a Completely New Type

★ *Progress Report to Oil Field Tractor Users*

NEW DESIGN MAKES DOZER PART OF TRACTOR

Allis-Chalmers HD-9 Tractor and No Push-Beam Dozer

A GREAT NEW TRACTOR. This new Allis-Chalmers HD-9 Tractor has power, weight and balance that puts it in a class by itself — never such traction . . . such pushing and pulling ability.

A REVOLUTIONARY TEAM. Here is a tractor-dozer combination designed together as a unit, which compares in performance with conventional "dozers" weighing from five to six thousand pounds more.

NO PUSH BEAMS. The 9X blade is mounted directly to the HD-9 main frame which actually makes dozer part of tractor. The tractor main frame and dozer are raised and lowered as a single unit.

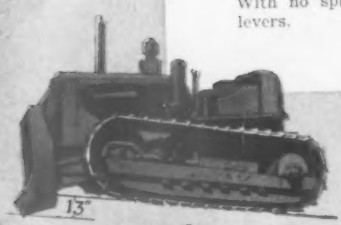
LIGHTER WEIGHT—BETTER STABILITY. Almost 1,150 lb. lighter than standard dozer. Costs less to buy. And with blade mounted 15 inches closer to tractor, center of gravity is changed only slightly. Less wear on front truck wheels and idlers of tractor.

BIG DIRT MOVER. You get extra yardage because the HD-9's combination of features makes it a real bulldozer tractor — outstanding lugability with powerful GM 2-cycle diesel engine — superior traction with longer track, wider tread.

A REAL "MUDDER". Because new type blade mounting provides extra clearance, greatly increased track oscillation and better balance, this team is a phenomenal performer in mud and tough going.

SIMPLIFIED SERVICING. 1,000-hour lubrication of truck wheels, idlers, and support rollers. Unit construction — major tractor assemblies are removable without disturbing companion parts. Dozer mounting does not interfere with engine accessibility. Hinged grill swings out for easy access to dozer hydraulic pump, or to clean radiator core.

EASY TO OPERATE. Just by pulling a single lever, operator can shift from any one of the six forward speeds to any one of the three reverse speeds. This, plus narrow, frame-mounted blade makes the HD-9 particularly fast and maneuverable. With no spring deflection, blade responds immediately and positively to control levers.



BITES DOWN HARD
Full 13-in. drop below ground. Positive down pressure plus steep blade angle means fast penetration.

HIGH LIFT
Full 37 in. above ground. Excellent for pushing over trees and stumps and clearing brush.

ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

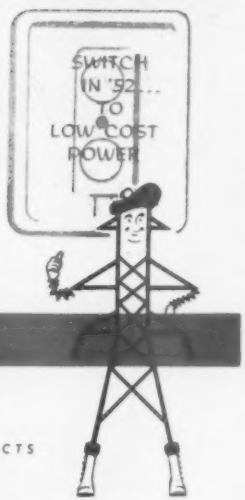
Tractor-Dozer for Oil Field Use

The new Allis-Chalmers HD-9 Tractor with Baker 9X no push-beam bulldozer provides these advantages that oil field users have been asking for — **PERFORMANCE — better maneuverability, increased traction in mud and tough going . . . steeper blade penetration permits cutting short, steep pit ramps for faster slush pit digging. TRANSPORT — lighter weight, highway-width blade for 24-hour-a-day transport without special permit. SERVICE — greater accessibility for easier lubrication and maintenance** . . . and at a new, lower original cost. Your Allis-Chalmers dealer will gladly tell you more about how this new combination meets specialized oil field requirements.

Down goes a slush pit — fast. Note how steep blade angle reduces length of ramp. Note how higher, narrower blade handles a bigger vertical load — speeds digging of deep, narrow pit.

. . . to cut costs the Petroleum Industry has switched to *Electric Power*

Pipe line operators discovered many years ago that Electric Power was the answer to lower power cost. Regardless of the job to be done in moving fluid, Electric Power usually can do it more satisfactorily — *and for less.* Above is shown an application by a major oil company near Antioch, Oklahoma, utilizing 1-200 H.P. and 1-75 H.P. and several smaller pump motors for pumping crude oil. Electric Power is also used for tank gauging. Your power problems can be simplified, too, by using Electric Power. Let us PROVE IT TO YOU — now.



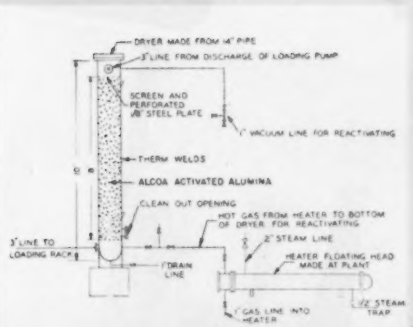
Petroleum Electric Power Association

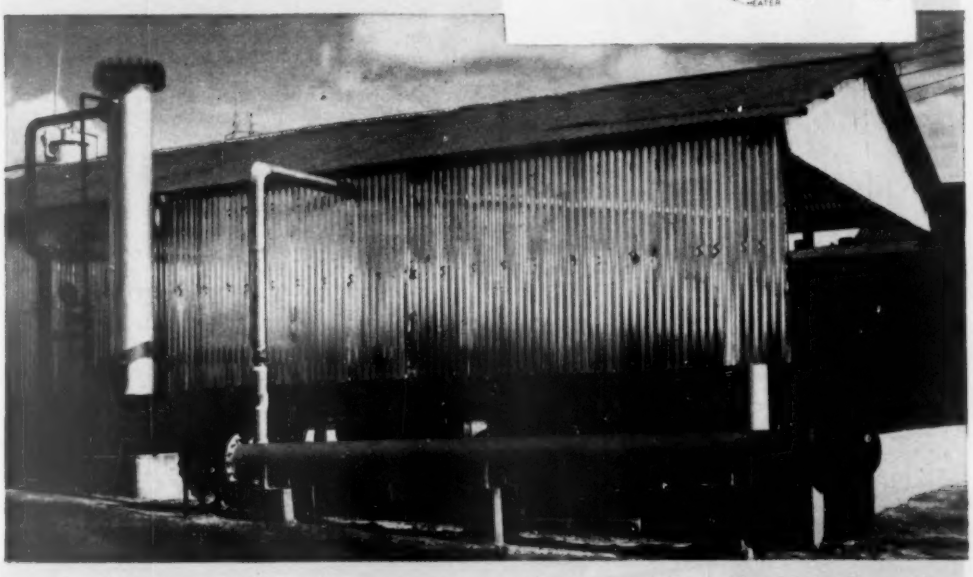
ORGANIZED IN THE INTEREST OF GREATER SERVICE TO THE PETROLEUM INDUSTRY

CALL YOUR NEAREST ELECTRIC SERVICE COMPANY FOR MORE FACTS
OR ADDRESS YOUR REQUEST TO P. O. BOX 2771, DALLAS, TEXAS

How **ALCOA** Activated Alumina dries propane for tank car loading . . .

Propane dryer, Gregg-Tex Gasoline Corp., Greggton, Texas. Propane enters top of dryer from storage, passes through 8′ bed of Alcoa Activated Alumina, discharges from 3″ bottom outlet to loading line. Unit dries to *minus* 30° F. dew point at 375 psig. Dehydration is on 6-hour cycles. Reactivation takes 4 hours, with hot residue gas at 14 mcf./hr.


DRYER MADE FROM 14" PIPE
3" LINE FROM DISCHARGE OF LOADING PUMP
SCREEN AND PERFORATED 1/8" STEEL PLATE
1" VACUUM LINE FOR REACTIVATING
THERM WELDS
ALCOA ACTIVATED ALUMINA
CLEAN OUT OPENING
HOT GAS FROM HEATER TO BOTTOM OF DRYER FOR REACTIVATING
3" LINE TO LOADING RACK
2" STEAM LINE
HEATER FLOATING HEAD MADE AT PLANT
1" DRAIN LINE
1/2" STEAM TRAP
1" GAS LINE INTO HEATER



Gregg-Tex can now load *12 tank cars* of propane before any trace of moisture shows on a tester, thanks to Alcoa Activated Alumina. This steady, reliable desiccant dries 120,000 gal. of plant product every day, yet is reactivated, good as new, in four hours.

Here, again, is proof of the day-in-day-out dependability and versatility of Alcoa Activated Alumina. Throughout the petroleum industry you'll find Alcoa Activated Alumina drying liquids, gases, air and gaseous hydrocarbons to *lower* dew points than any other commercial adsorbent.

If you have a drying problem, let us tell you of the economies offered by the oldest, most thoroughly proved desiccant in the petroleum industry. Write to ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 618-M Gulf Building, Pittsburgh 19, Pa.

Alcoa Chemicals

ALCOA **ALUMINAS and FLUORIDES**

ACTIVATED ALUMINAS • CALCINED ALUMINAS • HYDRATED ALUMINAS • TABULAR ALUMINAS • LOW SODA ALUMINAS ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOBORIC ACID • CRYOLITE • SALLFIN

All SHELL AND TUBE ...HEAT EXCHANGERS by Vogt

ABOVE: View of new construction at Louisville Refining Company.

BELOW: Some of the many Shell and Tube Exchangers.

Engineered and Licensed by UNIVERSAL OIL PRODUCTS CO.

At LOUISVILLE REFINING CO.'S New CATALYTIC CRACKING PLANT

Premium gasoline production has been boosted 20% from the same amount of oil charged since the Louisville Refining Company's new Catalytic Cracking Plant went on stream.

The new plant uses Vogt Shell and Tube Heat Exchangers exclusively and they make a significant contribution to the efficient and economic operations of this progressively modern refinery.

Vogt Shell and Tube Heat Exchangers are available in many different types, with fixed or removable tube bundles, to meet the special problem and specific operating conditions of each installation. They are constructed from carbon and special steels to meet every temperature, pressure, or vacuum service requirement.

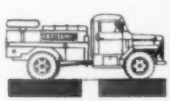
WRITE FOR BULLETIN HE-6

HENRY VOGT MACHINE CO. Louisville 10, Ky. • BRANCH OFFICES: NEW YORK, PHILADELPHIA, CHICAGO, CLEVELAND, ST. LOUIS, DALLAS, CHARLESTON, W. VA.

4-wheel traction plus all these advantages make the FWD Light Duty LD a

"work-anywhere" geophysical unit

The FWD light-duty LD makes an ideal explosives or water carrier, drill or communications truck.



Proper Weight Distribution Only a true 4x4 gives you up to 40% of the weight on the front wheels. This gives you the extra traction needed to work in any footing, any weather.

A Leader for Geophysical Service The LD is the answer for work which conversions and conventional trucks have long sought to do. As a water carrier it makes more trips daily, as a drill truck it reaches more locations, drills more holes daily. Can also be equipped as a shooting or recording truck, or to haul equipment and supplies.

Real Truck Engine—Real Truck Parts The FWD LD is designed and built for rugged use . . . pays off in more productive time, fewer breakdowns in field.

High-Climb Oil Sump Keeps oil pump constantly submerged. An FWD exclusive that lets you drill holes on the steepest grades.

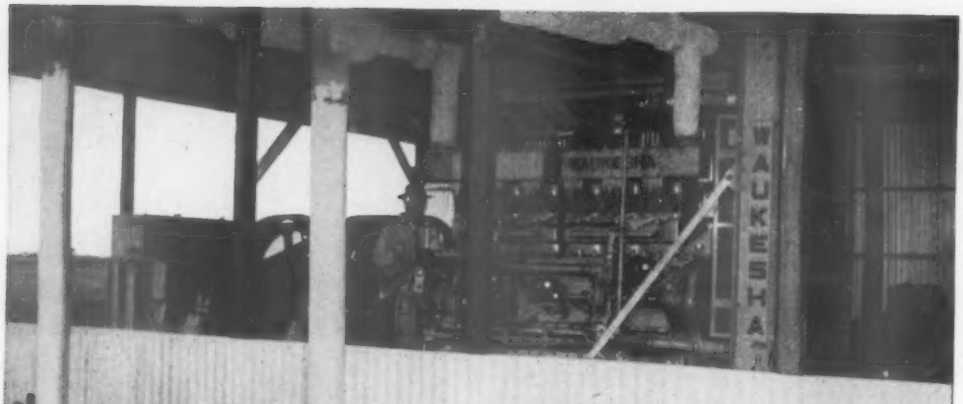
For the hundreds of assignments in and around the fields or along the pipelines that require a small, economical, *go-anywhere* truck . . . this light-duty LD has no equal.

Only FWD-built trucks offer so many features that provide *your crews* with a versatile, dependable rig. Only FWD-built trucks have so many advantages which contribute to operating economy and longer, trouble-free service that give you top value for your equipment dollar.

For all the facts, see your FWD Dealer or write direct.

THE FOUR WHEEL DRIVE AUTO CO.
Clintonville, Wis. *Canadian Factory*: Kitchener, Ont.

Built by the makers of America's Foremost Heavy-Duty Trucks



"never junked a WAUKESHA!"

Lenoir M. Josey, Inc., of Houston, saves gas with closed gas lift on 5 wells in Hutchins-Kubela field, Wharton County, near El Campo, Texas.

A Waukesha 6-LROU, 6-cyl., 8½ x 8½, 2894 cu. in. unit powers pump in compressor plant shown. Inlet gas scrubber (*left*) surge "bottles" (*right*).

194

The new Model LROU Waukesha which you recently installed in our gas lift plant at El Campo, just "fills the bill". It has sufficient power to take care of the heavy loads when the suction is flooded with gas lift gas from the wells, yet it runs smooth during the periods when the suction is low and the load is off.

This is the third installation of Waukesha in our campaign to eliminate flare gas on leases in Texas. During the past year, we have spent nearly a quarter of a million dollars in conservation practices and Waukesha Engines have figured in every installation. This was prompted by our records showing long service life and low costs of upkeep on our Waukesha installations.

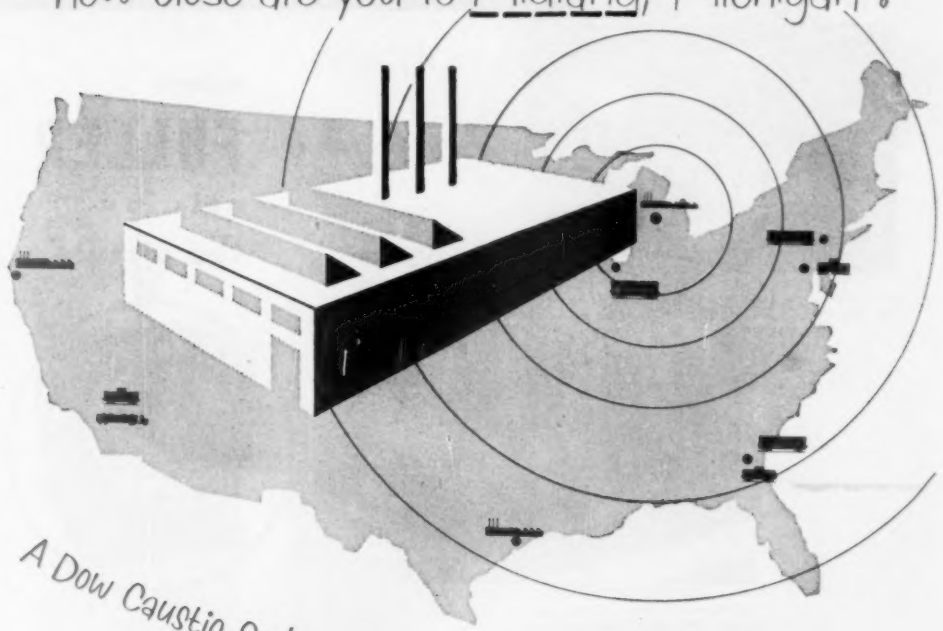
We have 38 Waukeshas of various models and ages on our producing leases. Many of these are 10 to 15 years old and we have never junked a Waukesha Engine. For this reason, we have standardized as near as possible on Waukesha Engines.

W. D. Carleton, Prod. Supt.
LENOIR M. JOSEY, INC.

Send for Waukesha Bulletin No. 1560

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS. • *New York* • *Tulsa* • *Los Angeles*

how close are you to Midland, Michigan?



A Dow Caustic Soda manufacturing and distribution center!

The Petroleum Industry Needs Thousands of Tons of Caustic Soda Each Year!

To keep production steady, the petroleum industry demands prompt delivery of caustic soda. For this reason Dow maintains an outstanding network of distribution facilities. In addition to Dow's caustic soda manufacturing plant and complete distribution center in Midland, Michigan—Dow operates caustic soda plants in Freeport, Texas and Pittsburg, California. Dow caustic soda solution is shipped from bulk tank terminals in Los Angeles, California; Carteret, New Jersey and Charleston, South Carolina. Caustic soda solid, flake and ground flake are shipped from terminals in Port Newark, New Jersey; Chicago, Illinois and Charleston, South Carolina. All of these distribution points play an important part in providing the petroleum industry with the superior service it requires.

wherever you are... *you're close to*

DOW CAUSTIC SODA

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Atlanta • Cleveland • Detroit
Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle
Dow Chemical of Canada, Limited, Toronto, Canada

DOW

CHEMICALS

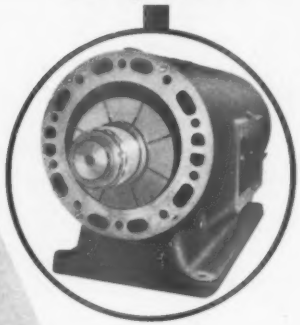
INDISPENSABLE TO INDUSTRY AND AGRICULTURE

gas gets a better boost

when FULLER gets in the picture

Five two-stage gas boosters, each handling 1,770,000 SCFD from 10 to 120 psig, at 800 rpm, V-12 Climax gas engine drive.

Single-stage gas booster, handling 2,400,000 SCFD from 150 to 250 psig, at 870 rpm, Waukesha gas engine drive.



Single-stage gas booster handling 3,560,000 SCFD, from 15 to 45 psig, V-12 Climax gas engine drive through gear speed reducer.

Consider Fuller Rotary Compressors in the overall picture of your operations. In booster work, whether for field boosting or to trunk-line levels, you'll find these compressors doing a better job . . . better because they reduce maintenance cost, cut inspection time, last longer, do the job efficiently.

Pulsations and vibrations, valves and complicated parts are eliminated by multi-vane rotary construction. Moving parts are few . . . rotor, blades, bearings. Blades automatically compensate for wear, maintaining full capacity for the life of the machine. These features explain why Fuller boosters do an outstanding job wherever gas is handled.

If you're interested in getting maximum efficiency and economy into your operation, investigate the Fuller Rotary. Send for a copy of Bulletin C-6, containing detailed description of these machines.

FULLER COMPANY, Catasauqua, Pa.
Chicago 3—120 So. LaSalle St.
San Francisco 4—420 Chancery Bldg.

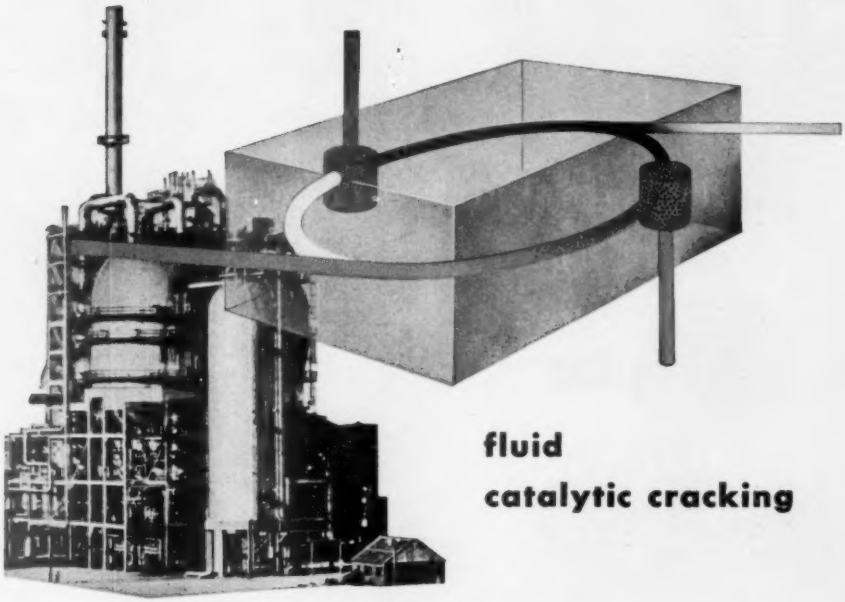
Two two-stage gas boosters, each handling 1,500,000 SCFD, with atmospheric inlet pressure, or 2,500,000 SCFD, 10 psig inlet pressure, can be handled, compressing to 70 psig discharge.

C-222
1814

Fuller

PIONEERS OF HIGH-EFFICIENCY VANE-TYPE ROTARY COMPRESSORS

reaction in steel...



fluid
catalytic cracking

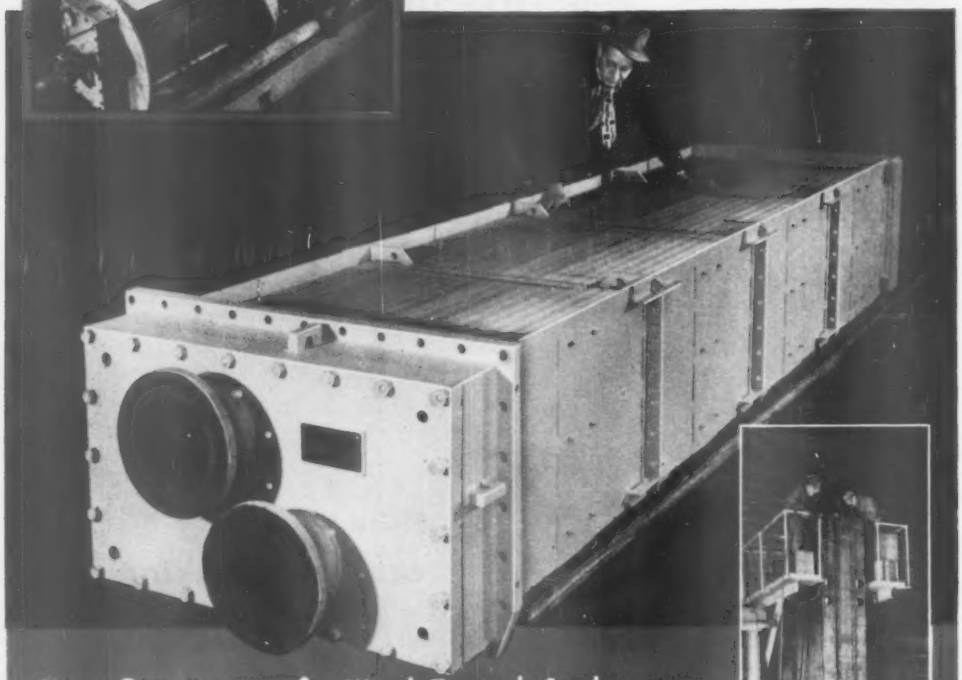
No matter how ideal the flow,
the process, in plant size,
must be contained and controlled in steel.

That's an important step in our job.
We've been doing it for over 30 years,—and
have designed, constructed and placed in operation
more than 600 petroleum processing units.

FOSTER WHEELER CORPORATION
165 BROADWAY, NEW YORK 6, NEW YORK

Each heat exchanger is individually hydrostatically tested to insure against leakage during operation. While under test, the by-pass baffles are welded on the unit.

One of the many wind tunnel heat exchanger sections, ready for shipment and installation in the Langley Aeronautical Laboratory supersonic wind tunnel, Langley Field, Virginia.



New **Supersonic** Wind Tunnel Coolers are A. O. Smith **Engineering Achievement**

Assembling tubes into the tube headers for one of the heat exchanger sections.

All wind tunnel coolers for the new supersonic wind tunnel under construction at Langley Aeronautical Laboratory of NACA, Langley Field, Virginia, were supplied by us.

A. O. Smith engineers conceived an original design in these heat exchangers, incorporating many advantages. The most important ones are:

1. High efficiency through balanced distribution of surface and flow areas.
2. Removable tube bundles.
3. Safety from air contamination by water, through elimination of bolted joints inside the tunnel and placing all water lines and connections outside air chamber.

INDUSTRY COMES TO A. O. SMITH WITH HEAT EXCHANGER PROBLEMS

These and many similar features make this one of the most advanced engineering feats in cooling provision for wind tunnels.

Besides manufacturing varying sizes and arrangements of heat exchangers, we also designed cooler housings, accessory equipment, and air by-pass system, calculated ducts and provided installation.

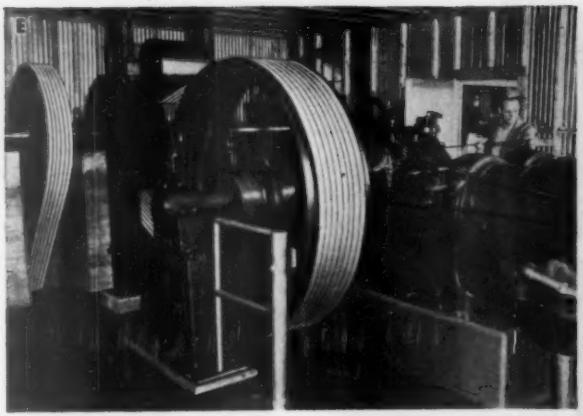
This is an excellent *example* of the completeness and flexibility of A. O. Smith engineering which is available to you to help solve YOUR heat exchanger problems . . . available through our nearest office, listed below.

Research and Engineering Building

A.O.Smith

VESSELS • HEAT EXCHANGERS

Chicago 4 • Cleveland 13 • Dallas 2 • Denver 2 • Houston 2
Los Angeles 22 • Midland 5, Texas • New Orleans 12
New York 17 • Pittsburgh 19 • San Francisco 4 • Seattle 1
Tulsa 3 • Washington 6, D.C.
International Division: P.O. Box 2023, Milwaukee 1, Wis., U.S.A.



An extremely compact layout is made possible by the use of these Gates Vulco Rope Drives at the Bivins, Texas, plant of the Brookenridge Gasoline Company. The drives connect an engine with a line shaft driving cooling water and still circulation pumps.

Why a V-Belt with Concave Sides Wears Longer...

—Just try this yourself!

Pick up *any* V-Belt and bend it as if it were going around a pulley. As it bends, grip its side between your fingers and thumb. Here is what you will feel—*every time.*

If the V-Belt has *straight sides,* you feel those sides *bulge out.* This forces the sides of the belt to press *unevenly* against the V-Pulley and you naturally get *concentrated* wear along the bulge —as shown in figure 1-A, below at right.

Now, try this same test with the belt that is built with CONCAVE SIDES—the Gates Vulco Rope!

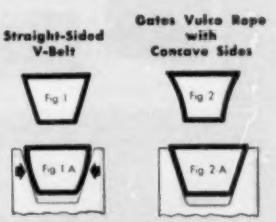
You find that the CONCAVE SIDES fill out and become perfectly straight. The sides press *evenly* against the V-Pulley. All wear is distributed *uniformly* across the *full width* of the Gates Vulco Rope—and this means *longer* belt *life* and *lower* belt *costs* for you.

The CONCAVE SIDES of Gates Vulco Ropes (U. S. Patent No. 1813698) clearly give you (1) Less wear, (2) More pulley contact, (3) More sure power transmitted when needed!

When you buy V-Belts, be sure to get the V-Belt with the CONCAVE SIDES—the Gates Vulco Rope!

Gates Engineering Offices and Jobber Stocks are located in all industrial centers of the United States and in 71 foreign countries.

What Happens When a V-Belt Bends



How Straight-Sided V-Belt Bulges in the Sheave-Groove. Sides Press Unevenly Against the V-Pulley, Causing Extra Wear at Point Shown by Arrows.

The Concave Sides Fill Out to a Precise Fit in Sheave-Groove. No Side-bulge! Sides Press Evenly Against the V-Pulley—Uniform Wear—Longer Life!

CS-5211

V-Belts — Hose
Molded Rubber Goods
for industry
World's Largest Maker of V-Belts

Gates® VULCO ROPE DRIVES

THE GATES RUBBER COMPANY • DENVER, U.S.A.

STANDARDIZED PARTS ON

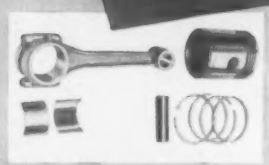
MINNEAPOLIS MOLINE MM OILFIELD POWER

POWER UNITS

*

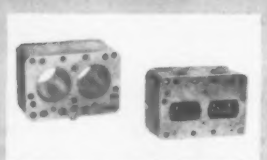
assure longer lower cost

Oilfield Service!



Connecting rods are drilled and have precision shell bearing inserts. Pistons are assembled in matched sets

Crankshafts and camshafts are of heavy section design, extra-large bearing area



Removable cylinder blocks and heads are cast in pairs separate from crankcase

Water jacketed base pan with built-in oil filter means longer service

* **10 YEARS OF CONTINUOUS OPERATION, 86,359 HOURS UNDER LOAD WITHOUT REPAIRS!** That's the record of an MM Power Unit for its California owner (name on request). More important are these facts which were attested to when the unit was dismantled and moved to another location: Crankshaft journals were smooth and showed a maximum wear of .0008; connecting rod journals showed maximum wear of .0005; main bearing shells had worn .001 or less and cylinders miked within .0028 *thru entire bore!*

There's a proud record and here's the reason: Standardized parts on MM Power Units make possible the very finest machine tooling, consequent closer tolerances and greater precision in production. That's your assurance that *MM means more for your money . . . better parts for lower cost at those infrequent times when even an MM needs servicing!*

Standardize on MM for lower-cost interchangeability that requires smaller spare part stocks.

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somewhere in your building,
lurking like a cat....
fire is ready to pounce.
In flammable liquids,
electrical equipment, record
vaults. Your surest protection
is a Kidde Fully Automatic
CO_2 Fire Extinguishing System.

Kidde

...quick as a mouse, check the "Yellow Pages" for your KIDDE dealer

Walter Kidde & Company, Inc.,
1254 Main Street, Belleville 9, N. J.
Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.

Metameter Telemeter Receivers in dispatching office, Midland Building, Kansas City, Mo., record suction and discharge pressures and static and differential pressures coming in by microwave from distances nearly 400 miles away. They give dispatcher a continuous visual picture of pressure conditions along Panhandle Eastern Pipe Line system.

MICROWAVE METAMETER TELEMETERING on the PANHANDLE EASTERN pipe line

Gives dispatcher the information he needs for better pressure regulation—enables him to foresee abnormal conditions and prevent interruptions—promotes greater operating efficiency

Bristol Metameter® Telemeters, using microwave transmission over some 400 miles of this company's pipe line system, bring readings of compressor suction and discharge pressures and static and differential pressures to the Kansas City dispatching office where they are recorded by 12 Metameter receivers within sight of the dispatcher.

Continuous information about suction and discharge pressure at Houstonia, Centralia, Pleasant Hill, Glenarm, and Tuscola, Ill., compressor stations and static and differential pressures at Tuscola enables the dispatcher to obtain better pressure regulation and to foresee abnormal situations and make corrections before they cause interruptions. Continuous observation of pressures along the pipe line system promotes economies and a feeling of security.

Metameter Telemeters are widely used with microwave radio communication systems. Provisions for future use or additional Metameter Telemeters are made on many microwave systems at the time of installation.

Other uses by pipe line companies include remote setting of regulators and flow controllers; remote readings of line pressure; sounding low and high pressure and flow limits alarms; totalizing flow through several lines.

For further information on the use of Bristol Metameters by pipe line and gas companies, from coast to coast, request Bulletin M1700, THE BRISTOL COMPANY, 120 Bristol Road, Waterbury 20, Conn.

®Reg. U. S. Pat. Off.

BRISTOL

The dependable Guidepost of Industry

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

AEROQUIP SELF-SEALING COUPLINGS

AND FLEXIBLE HOSE LINES

Speed Maintenance

WHEREVER FLUID-CARRYING LINES MUST BE DISCONNECTED AND RECONNECTED

Speed **maintenance,** ***speed*** **repair operations and** ***speed*** **interchanging of accessories joined by fluid-carrying lines with Aeroquip Self-Sealing Couplings. Lines may be separated in a few seconds without loss of fluid. No air enters the system upon reconnection. There is no need to drain or prime the fluid system. One Self-Sealing Coupling takes the place of two shut-off valves.**

Aeroquip

REG. TRADE MARK

AEROQUIP CORPORATION, JACKSON, MICHIGAN

SALES OFFICES: BURBANK, CALIF. • DAYTON, OHIO • HAGERSTOWN, MD. • HIGH POINT, N. C. • MIAMI SPRINGS, FLA. MINNEAPOLIS, MINN. • PORTLAND, ORE. • WICHITA, KAN. • TORONTO, CANADA

AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD

Johnson SEA-HORSES FOR DEPENDABILITY

Shown above is a drilling operation of the Arkansas Louisiana Gas Company, of Shreveport. The boat in the foreground is powered by a 10 hp Johnson Sea-Horse outboard motor.

This company has found outboard motors indispensable in their work—in transporting men and material—in making soundings and inspections—in reaching properties, wells, and mainline gates in high-water periods.

If you use boats in *your* operation, be sure to look into the money-saving, work-saving features of Johnson Sea-Horses. Be sure to see for yourself how these famous marine engines will take your boats where others dare not venture. And be sure to check outstanding Johnson features such as: Gear Shift (neutral, forward, reverse), 6-gal. Mile-Master Fuel Tank, Synchro Twist-Grip Speed Control, Neutral Clutch, Angle-matic Drive.

See your Johnson dealer. Look for his name under "Outboard Motors" in your classified phone book.

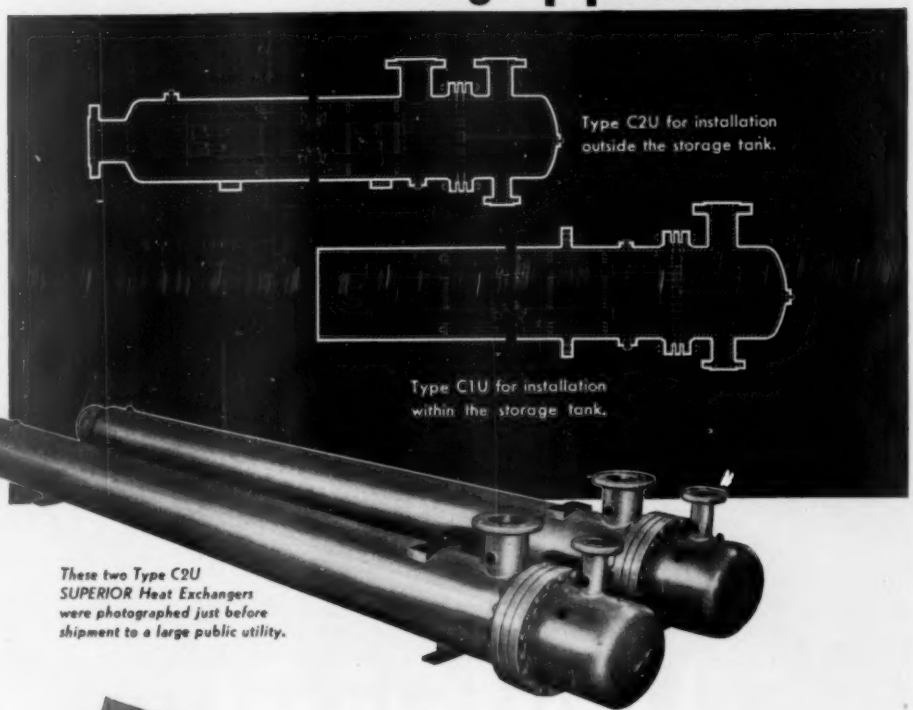
A 10 hp "work horse." With Gear Shift and separate 6-gallon Mile-Master Fuel Tank for hours of running without refueling.

FREE! Write for fully-illustrated literature on the 4 versatile Johnsons for 1952—ranging from 3 hp to 25 hp. A size for every outboard need!

JOHNSON MOTORS, 6600 Pershing Road, Waukegan, Illinois
In Canada: Mfd. by Johnson Motors, Peterborough

All hp is OBC *certified* brake hp at 4000 rpm.

How to *HURRY* heavy oils through pipelines . . .



These two Type C2U SUPERIOR Heat Exchangers were photographed just before shipment to a large public utility.

This eight-page, two-color catalog describes basic design features of heads, shells, and tube bundles. Write today for Catalog No. 520.

In process plants, refineries, bulk storage plants and tank farms, SUPERIOR Tank Heaters provide an efficient and highly dependable solution to the problem of heating heavy oils. Their "finned-U-tube" design provides greater heat-transfer surface combined with compactness.

Other SUPERIOR Heat Exchangers are designed specifically for boosting oil temperatures at pumping stations along the line, for cooling the pumps, and for the countless other applications for heat exchangers in the petroleum industry.

Our engineering department invites your inquiry regarding any proposed application as a basis for a specific engineering recommendation.

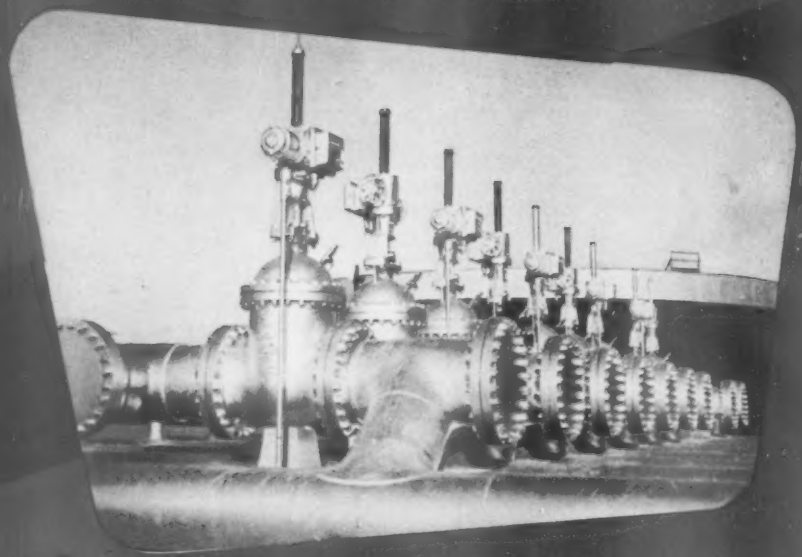
for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR HEAT EXCHANGERS

...Here's another example of

DEPENDABLE VALVE OPERATION



with...

LIMITORQUE VALVE CONTROLS

OUR 60TH ANNIVERSARY

This is another group among the thousands of LimiTorque Controls installed in major Refineries and Pipe Lines around the world. The installation is in southern U. S. and here the LimiTorque Controls operate Darling Gate Valves on 30" crude oil pipe line manifolds. LimiTorque is noted for dependable valve operation under all conditions, and also for providing a reliable means of remote control. Actuation is by any available power source. Get details in Catalog L-50.

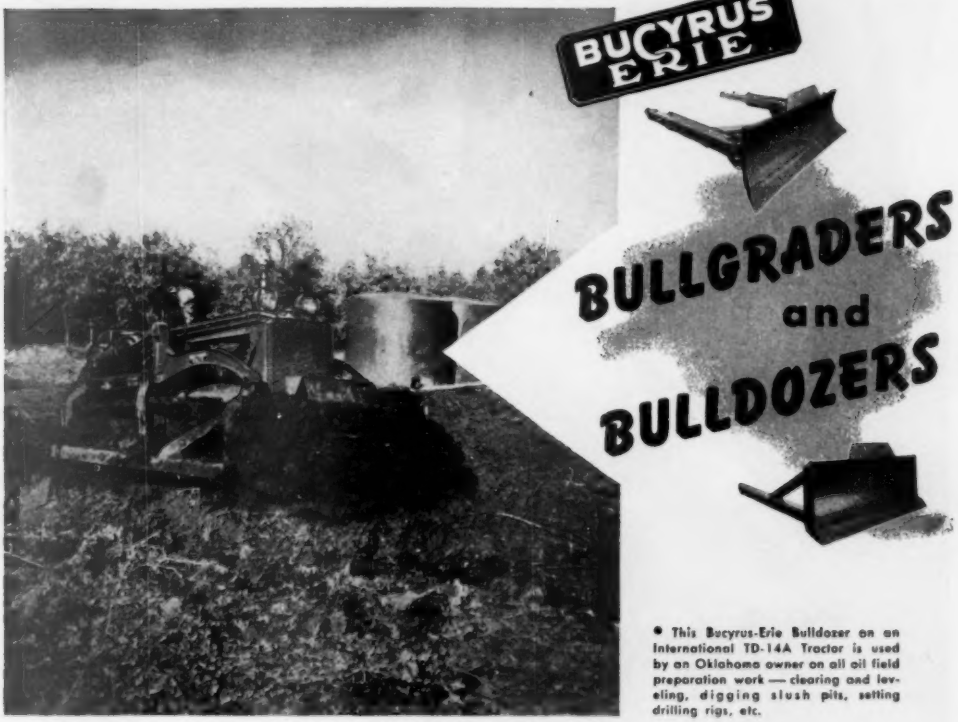
Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

Matched To Tractors for Top Performance



• This Bucyrus-Erie Bulldozer on an International TD-14A Tractor is used by an Oklahoma owner on all oil field preparation work — clearing and leveling, digging slush pits, setting drilling rigs, etc.

Bucyrus-Erie Bullgraders and Bulidozers become an integral part of International tractors on which they are mounted. The fact that they are completely *matched* to the tractors assures:

Accurate Working — Mounting a Bucyrus-Erie blade leaves a tractor's balance point almost unchanged. This means no gouging, nosing down or jerking — the blade accurately digs in and smoothly swings through the cut.

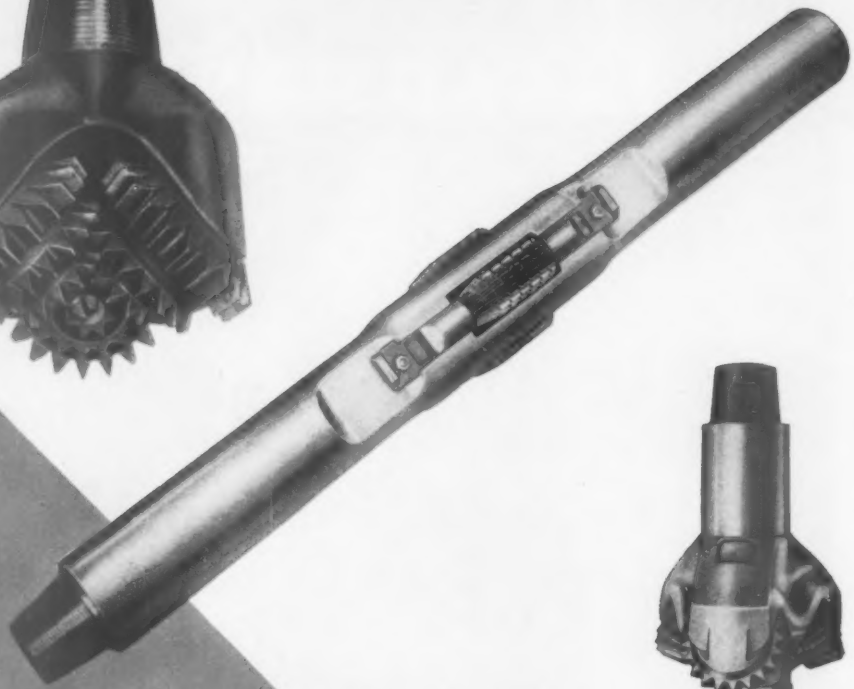
Full Power and Traction — With tractor balance maintained, tracks work full length on the ground, the operator can utilize the tractor's full power and speed, stability and maneuvering ability are retained for most efficient operation.

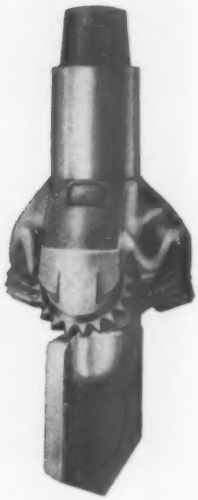
Low Tractor Maintenance — Loads and shocks are placed right where the tractor was designed to carry them. No damaging shocks to main frame, engine, transmission case or final drive housing. No overloading of front idlers and track rollers.

All this adds up to more time on the job, more work done while on the job. Get complete information about the winning combination of International tractors and *matched* Bucyrus-Erie Bullgraders and Bulldozers — from your International Industrial Tractor Distributor. 35152

BUCYRUS-ERIE COMPANY, South Milwaukee, Wisconsin

See Your INTERNATIONAL INDUSTRIAL TRACTOR DISTRIBUTOR





FOR *FASTER* DRILLING

SIX TYPES OF CP THREE CONE ROCK BITS: Type ES-1 for softest shales and other top-hole formations; Type ES-2 for soft shales and unconsolidated formations; Type ES-3 for soft to medium formations; Type EM-2 for hard sands and hard shales; Type EM-3 for rocks of high compressive strength; Type EH-1 for exceedingly hard, abrasive formations.

CP TYPE B REAMERS eliminate tapered holes and the need for reaming to bottom. Run close above the bit, a CP "bottom" reamer insures a true round, full-gauge hole. A CP "stabilizer" reamer centers the drill stem and prevents wall drag. Cutters are held securely in reamer body by tapered keys.

C-1 REAMING BITS give a smooth running, fast cutting, straight hole reaming job. Properly placed pilot blade guides reaming bit, assures concentricity of large hole with pilot hole. Unitized welded-in cutters prevent loose parts from falling off in the hole. Hard-faced cutters on ball and roller bearings give maximum cutter life.

Write for copy of Bulletin 1001.

CHICAGO PNEUMATIC TOOL COMPANY

MANUFACTURED AT FRANKLIN, PA.

GENERAL OFFICES: 6 EAST 44th STREET, NEW YORK 17, N. Y.

Oil Tool Division Office: One N. W. 16th Street, Oklahoma City, Oklahoma

In Canada: 10103 81st Avenue, So. Edmonton, Alberta, Canada • In Mexico: Mexico, D. F., Rosas Moreno No. 41; Tampico, Tamps., Apartado No. 174

Special Oil Tool Export Agent: E. F. Gahan, Inc., 500 Fifth Ave., New York 17, N. Y. (West Indies, Central and South America, exclusive of Mexico)

The entire IVERSON organization joins in wishing you a very Merry Christmas and a Happy New Year.
Your many favors and kindly consideration during 1952 has been greatly appreciated.

OFFICES
FORT WORTH
TEXAS

IVERSON SUPPLY COMPANY
DRILLING-PRODUCTION AND REFINERY EQUIPMENT
P.O. BOX 1439 TULSA 1, OKLA.

OFFICES
MIDLAND
TEXAS

FASTER HEAT TRANSFER FOR 50% OF THE COST

Stainless Steel Platecoils in a large variety of standard sizes or standard single embossed Platecoils rolled to specific diameters as shown above are finding increasing use in the chemical and textile industries because they give five basic advantages in solving heat transfer problems.

1. Lower first cost.
2. Simplified and less costly installation.
3. Take less space in tank.
4. Higher heat transfer rate.
5. No pipe joints in solution.

Platecoils heat faster than pipe coils because they have more prime surface in a given area. A 22" x 47" Platecoil has the same heat transfer surface as 32 feet of 1½" pipe which occupies approximately 30" x 60" of space. Platecoils' faster heating coupled with their unusually low maintenance cost give 50% savings in space and material resulting in faster heat transfer for heating or cooling problems for approximately 50% of the normal cost. It costs you nothing to see what Platecoils will do for you. Write for complete data on your problem today.

Your free copy of the Platecoil technical data manual is available when requested on your letterhead. Write for Bulletin No. P21

They Say—

Explosive Brew in Caracas

"Col. Perez Jimenez will have lots of support, and he may even have made a deal with the U.R.D., the party which won or was winning (the) election.

"He ought to be able to sit on the lid indefinitely, and things will continue as before. But it will be a lid put on an explosive brew, and the colonel must face the general condemnation of all to whom the legal process of election, and of democracy in general, mean more in the long run than the sort of 'law and order' which military juntas keep.

"If the ruling clique in Venezuela feel they are being maligned, there is a simple remedy—lift the iron curtain and let correspondents send freely what they can learn in Venezuela."

Editorial in the New York Times.

Praise for a New Gadget

Sir:

The Unit shown is a "Pneumatic Analog" machine for studying the interrelation between automatic control elements and Industrial Processes. It is,

we feel, the best of its kind in existence and is the only one built to date. We just acquired it a few months ago.

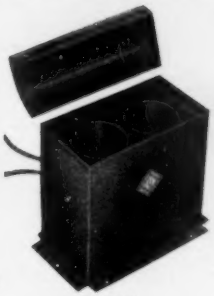
The instrument shown was obtained as an instruction and research unit. It permits demonstrating the behavior of various types of controls on a simple process and has a proper time constant range so the student can visually observe the various means of control and their influence on the process. We can cover the range from unstable to all degrees of stable control.

We are also carrying on studies of

COMPLETE OIL TESTING LINE (ELECTRIC)

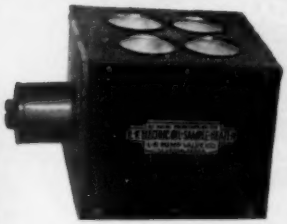
Patent Pending

HEATING CENTRIFUGE
6 volt — 3 styles

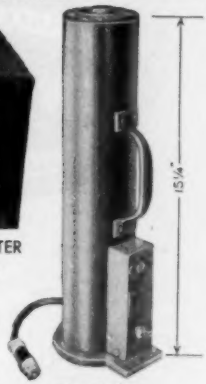


Patented

L-K ELECTRIC OIL SAMPLE HEATER
6 volt — 6 styles



L-K OIL SAMPLE HEATER
110 volt — 2 styles



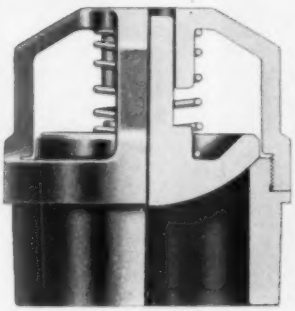
ELECTRIC HEATING HYDROMETER CYLINDER

Patent Pending

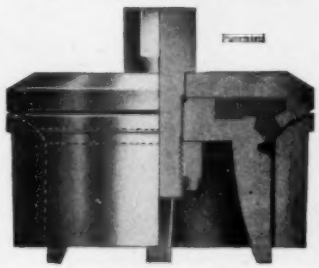
L-K
BALL BEARING
WIRE LINE CAT LINE
SWIVEL

OTHER OUTSTANDING L-K PRODUCTS

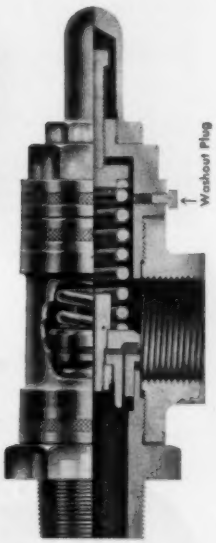
(L-K PUMP VALVES FURNISHED IN 11 STYLES)



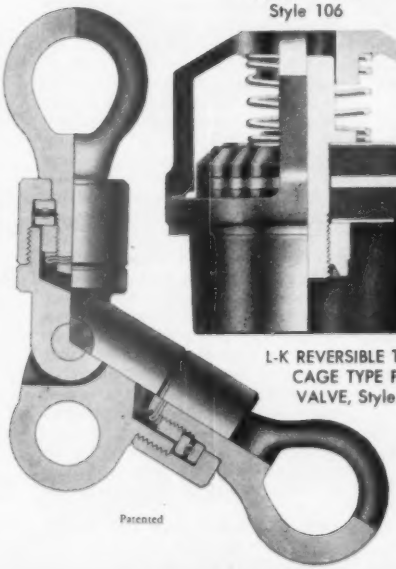
L-K ALL METAL CAGE TYPE
PUMP VALVE
Style 106



L-K STEEL PUMP VALVE
Style 103

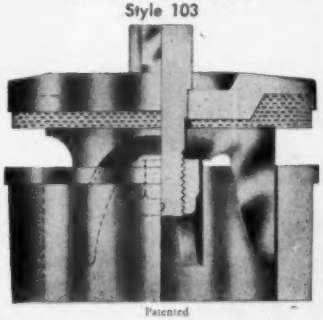


L-K
RELIEF VALVE



Patented

L-K REVERSIBLE TAPERED
CAGE TYPE PUMP
VALVE, Style 105



Patented

L-K REGULAR SLUSH PUMP VALVE
Style 102

L-K
DOUBLE SPINNING LINE
SWIVEL
8 styles

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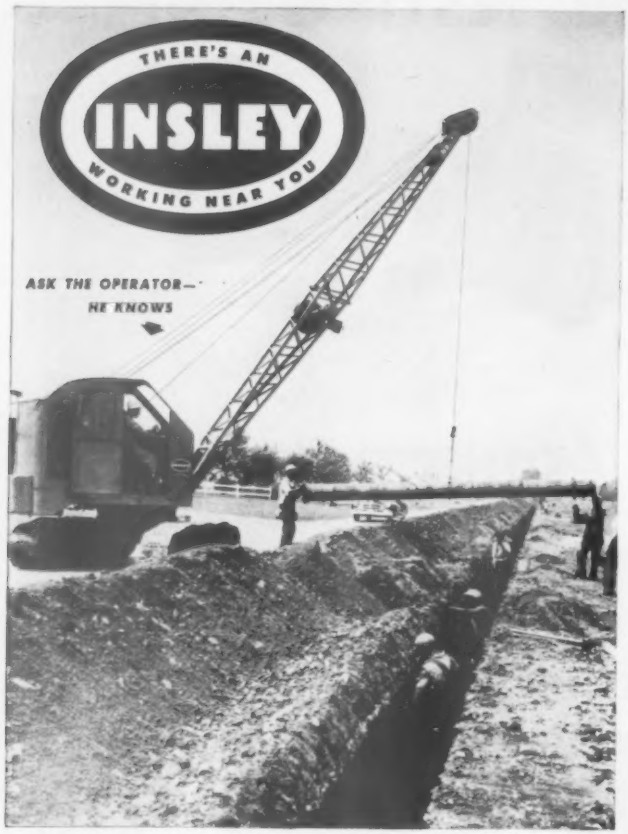
City ..... State .....



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the behavior of more complex processes involving what corresponds to three degrees of freedom systems. We can vary the characteristics of each of the elements of the more complex process as well as the kind and degree of control imposed. We hope to be able to develop a better understanding of the performance of complex systems and ultimately develop an analytical approach to the study of the problem. The final goal would be the development of rational methods of selection of automatic controls.

We recently ran one school on instrumentation here at the University of Minnesota for graduate credit and open only to men with an engineering degree. We had about half from industry and half graduate students. It worked out very well and was the occasion for the use of the above-described equipment.

Emory N. Kemler, Professor
Department of Mechanical Engineering
University of Minnesota.

Editor's note: Dr. Kemler, widely known for his work in petroleum research and educational fields, is the author of an informative article "Methods of Meeting the Increasing Shortage of Engineers," to be published in The Oil and Gas Journal in a January issue.

FPC Action Detrimental to Gas

"The (natural-gas) industry, which has been rolling along to new records in output and earnings, received a setback this summer in the shape of a changed policy as to rates by the Federal Power Commission.

"After having observed for years the generally accepted principle of a 6 per cent return on net property worth, the FPC apparently tossed it out in a decision on rate increase proposals filed by Northern Natural Gas Co. 2 years before. The commission allowed only 5½ per cent and at the same time denied the pipe line the right to charge the minimum price fixed by the State of Kansas for gas taken from its own reserves.

"The result of this adverse decision was immediately felt in the securities markets. Natural-gas stocks declined as a result of widespread selling by holders who saw appreciation possibilities diminished by this development. It appeared to eliminate the growth factor up to then inherent in the ownership of such issues. It ties in the rate of return on borrowed capital to the interest cost and so takes out the leverage factor from the common stocks. If this situation is allowed to prevail these equities will not be so attractive as

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OTHER PENBERTHY PRODUCTS

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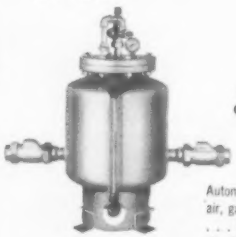

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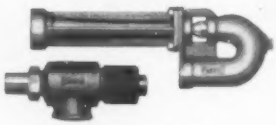
Automatically operated by air, gas or steam pressure . . . Will pump without clogging any liquid that will flow through pipes. Ask for Bulletin 5030.



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4672

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other growth securities unhampered by such restrictions."

George Ericson, financial-page editor, writing in the Christian Science Monitor.

CALENDAR OF EVENTS

JAN.

8- 9 Midwest Research Institute, symposium on automatic computing equipment, Kansas City.

15 American Institute of Chemists and American Chemical Society, symposium on public relations for chemists and chemical engineers, Hotel Commodore, New York City.

16-17 Independent Petroleum Association of America executive committee, quarterly meeting, The Campbell House, Lexington, Ky.

19-21 Pipe Line Contractors Association, fifth annual convention and exhibit, Shamrock Hotel, Houston.

19-22 American Society of Mechanical Engineers, and Society for Advancement, Plant Maintenance Conference, Public Auditorium, Cleveland.

19-23 American Institute of Electrical Engineers, winter general meeting, Hotel Statler, New York.

21-23 Southwestern Legal Foundation, fourth annual Institute on the Law of Oil and Gas and Taxation, Dallas.

27-28 Kansas Oil Men's Association, annual convention, Hotel Lassen, Wichita.

28-30 Symposium on Instrumentation for the Process Industries, Agricultural and Mechanical College of Texas, College Station.

FEB.

2- 6 Corrosion short course, sponsored by National Association of Corrosion Engineers, University of California, Berkeley.

5- 7 Missouri Petroleum Association convention, President Hotel, St. Louis.

16-21 American Institute of Mining and Metallurgical Engineers, annual joint meeting of petroleum, metals, and mining branches, Statler Hotel, Los Angeles.

18 Instrument Society of America, sixth annual New York regional meeting, Hotel Statler, New York.

18-19 Pacific Coast Gas Association, technical services conference of technical section, Hollywood, Calif.

27 Natural Gasoline Association of America, regional meeting, Scharbauer Hotel, Midland, Tex.

MAR.

2- 6 American Society for Testing Materials, spring meeting, Statler Hotel Detroit.

4- 6 American Petroleum Institute, division of production, Southwestern district spring meeting, Hilton Hotel, Fort Worth.

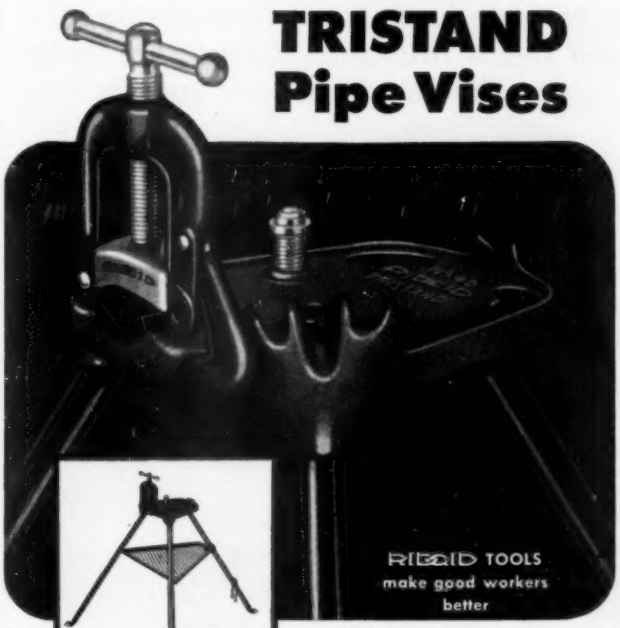
8-11 American Institute of Chemical Engineers, Buena Vista Hotel, Biloxi, Miss.

Why Good Mechanics Demand

RIDGID

New No. 40

TRISTAND Pipe Vises



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★ Tristand is really a portable workbench with a vise—roomy top tray has pipe benders and pipe rest; tool tray below keeps tools handy.

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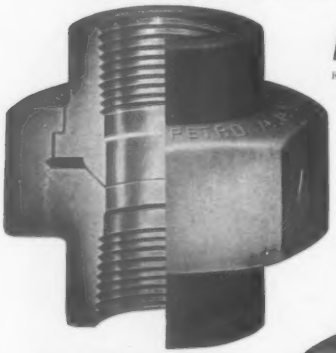
RIDGID

Work-Saver Pipe Tools

IT'S GRATIFYING

At this time of year to look back on your blessings and accomplishments, and recall the good things that helped contribute to your success



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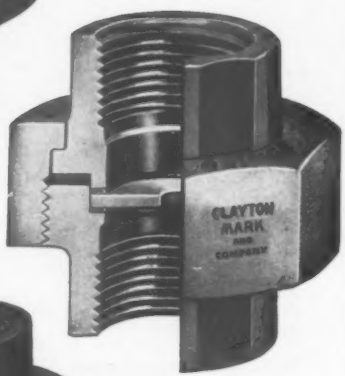

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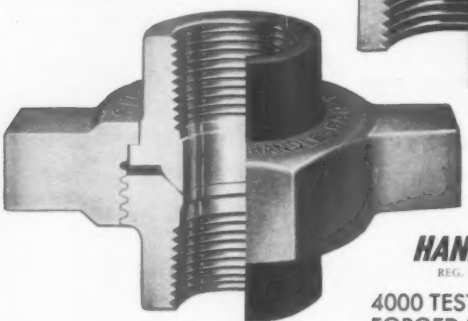

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15-20 American Chemical Society, petroleum division, spring meeting, Statler Hotel, Los Angeles.

16-20 National Association of Corrosion Engineers, ninth annual conference and exhibition, Hotel Sherman, Chicago.

18-20 American Petroleum Institute, division of production, Mid-Continent district meeting Mayo Hotel, Tulsa.

23-25 Western Petroleum Refiners Association, annual meeting, Plaza Hotel, San Antonio, Tex.

23-26 American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, and Society of Exploration Geophysicists, joint annual meeting, Sam Houston Coliseum, Houston.

30-31 Texas Independent Producers and Royalty Owners Association, annual meeting, San Antonio.

30-Apr. 1 Mid-West Gas Association, Broadmoor Hotel, Colorado Springs, Colo

APR.

7- 9 Petroleum Industry Electrical Association, annual convention and exhibit, Shamrock Hotel, Houston.

8-10 American Petroleum Institute, division of production, Eastern district meeting, William Penn Hotel, Pittsburgh.

15-17 National Petroleum Association, mid-year meeting, Cleveland.

21-23 Southwestern Gas Measurement Short Course, University of Oklahoma Norman.

24-25 Interstate Oil Compact Commission, 1953 spring meeting, Roosevelt Hotel, New Orleans.

26-29 American Institute of Chemical Engineers, Chemical Institute of Canada, joint meeting, Royal York Hotel, Toronto, Ont.

27-28 Independent Petroleum Association of America, mid-year meeting, Jefferson Hotel, St. Louis.

Apr. 29-May 1 Natural Gasoline Association of America, annual convention, Rice Hotel, Houston.

Apr. 30-May 1 American Gas Association, transmission and storage conference, Edgewater Beach Hotel, Chicago.

MAY

4- 5 American Petroleum Institute, division of marketing, midyear meeting, Baker Hotel, Dallas.

7- 8 American Petroleum Institute, Rocky Mountain district, Division of Production, spring meeting, Gladstone Hotel, Casper.

11-13 Southern Gas Association, Jung Hotel, Hotel, New Orleans.

11-14 American Petroleum Institute, Division of Refining, midyear meeting, New York.

13-14 Pacific Coast Gas Association, annual gas supply and transmission conference, Santa Barbara, Calif.

14-23 International Petroleum Exposition, Tulsa.

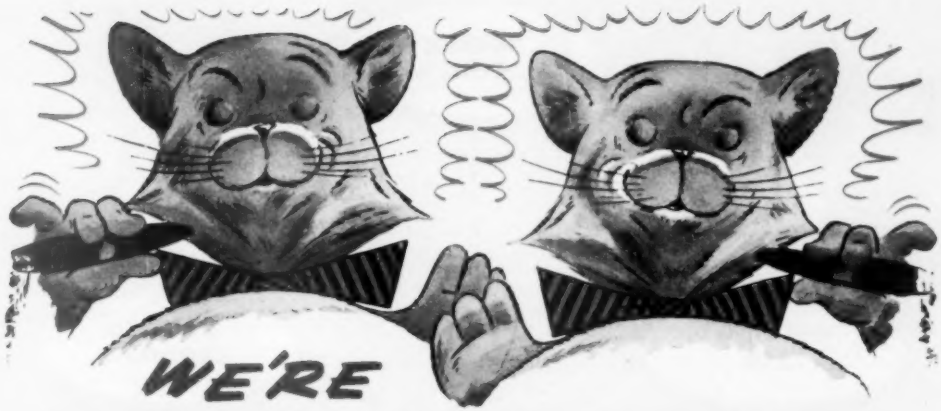
15-16 International Gas Union, council meeting, Paris, France.

24-27 American Gas Association, production and chemical conference, Hotel New Yorker, New York City.

28-29 Natural Gas and Petroleum Association of Canada, London, Ont.

JUNE

2- 3 American Petroleum Institute, Division of Production, Pacific Coast District, Statler Hotel, Los Angeles.



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TULSA, OKLAHOMA

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JOURNALLY Speaking

Foreign Intelligence

THIS issue of our favorite oil publication, as you will see when you get farther into it, is almost entirely devoted to oil doings in other lands, it being our annual International Number.

Since this comes on top of 51 regular issues which always contain several pages of reports on foreign oil activities and developments, we on the staff sometimes ask ourselves whether we are devoting too much space to areas outside continental United States.

But our readers all say no. Every survey we have ever made shows that our foreign intelligence is widely read and well received. They seem to want more of it rather than less.

The explanation goes beyond the normal human fascination with faraway places. A lot of oil men have worked in foreign fields, or have friends there, or expect to go sometime. The operating problems encountered abroad may have their counterparts almost anywhere. And with areas outside the United States now producing half the world's oil and increasing the percentage steadily, oil men in this country feel a real need to keep informed of trends and developments elsewhere.

So we edit our international material for oil men at home. Those abroad read the regular issues and keep up with the American oil industry, but we have learned that they also have an avid interest in what is going on elsewhere and that the Big Yellow Book's international coverage is the only place they can find out.

Travelog

TAKE me somewhere east of Suez, where the best is like the worst. . .

Our soul was one with Kipling in hankering for exotic lands beyond the seas when we looked at the picture section starting on page 158. To slip aboard one of those tankers and plow the briny deep with a wet sheet and a flowing sea and a fair wind following free . . . To explore the bends of that Malayan River on an awning-draped spirit launch while monkeys chatter derisively from the banks and who knows what dangers lurk behind the jungle walls . . . To bask on the deck of that houseboat moored beneath the sheltering palms while Indonesian maidens drift by in dugout canoes. . . To get stuck in the mud on that Venezuelan pipe-line job while the sun beats down inexorably and the insects swarm by the millions—oh nuts, why did they have to use that picture? Our dream is shattered by the realization that there's probably work connected with every job and that the American standard of plumbing, pavements, and pasteurization have certain advantages which, however prosaic, may offset the romance of remote regions.

Guess we'll stay home after all and do our traveling vicariously via Kipling, the National Geographic, and The Oil and Gas Journal.

Curtains

WANT to know how we got all the dope on foreign oil fields, refineries, and pipe lines? Very simple. We asked for it. We sent questionnaires all over the world and got complete cooperation everywhere except from two areas: the Iron Curtain of the Communists and the Peron Curtain of the Argentines so far as government operations are concerned. We had to estimate what is going on there, piecing together gleanings of unofficial information.

Seasonal Note

THE Korean war, the Communist threat, and the crowds that hampered our desperate last-minute shopping here practically made a Scrooge out of us, but we finally recovered in time to absorb enough of the spirit of the season to wish all readers of this department

Merry Christmas

Henry D. Ralph.

Season's Greetings
H C Smith
OIL TOOL COMPANY

Petroleum—the base for a peaceful world

TO those whose Yuletide joys and hopes are mingled with forebodings as to the future, we believe a perusal of this, our International Number, will be reassuring.

For again the year-end reports reveal that the free peoples of the world have further fortified themselves against a common enemy in the possession of the most essential commodity of war and peace—petroleum. Continued expansion during the coming year will strengthen that position.

Since 1946 Russia and her satellites are credited with increasing crude-oil production 519,000 bbl. daily. The gains elsewhere have totaled 4,296,000 bbl. daily or eight times greater.

The increase in Texas alone for the 6-year period has been twice that of the dictator countries. Gains in the Middle East, despite the shutdown in Iran, are two and one-half times greater.

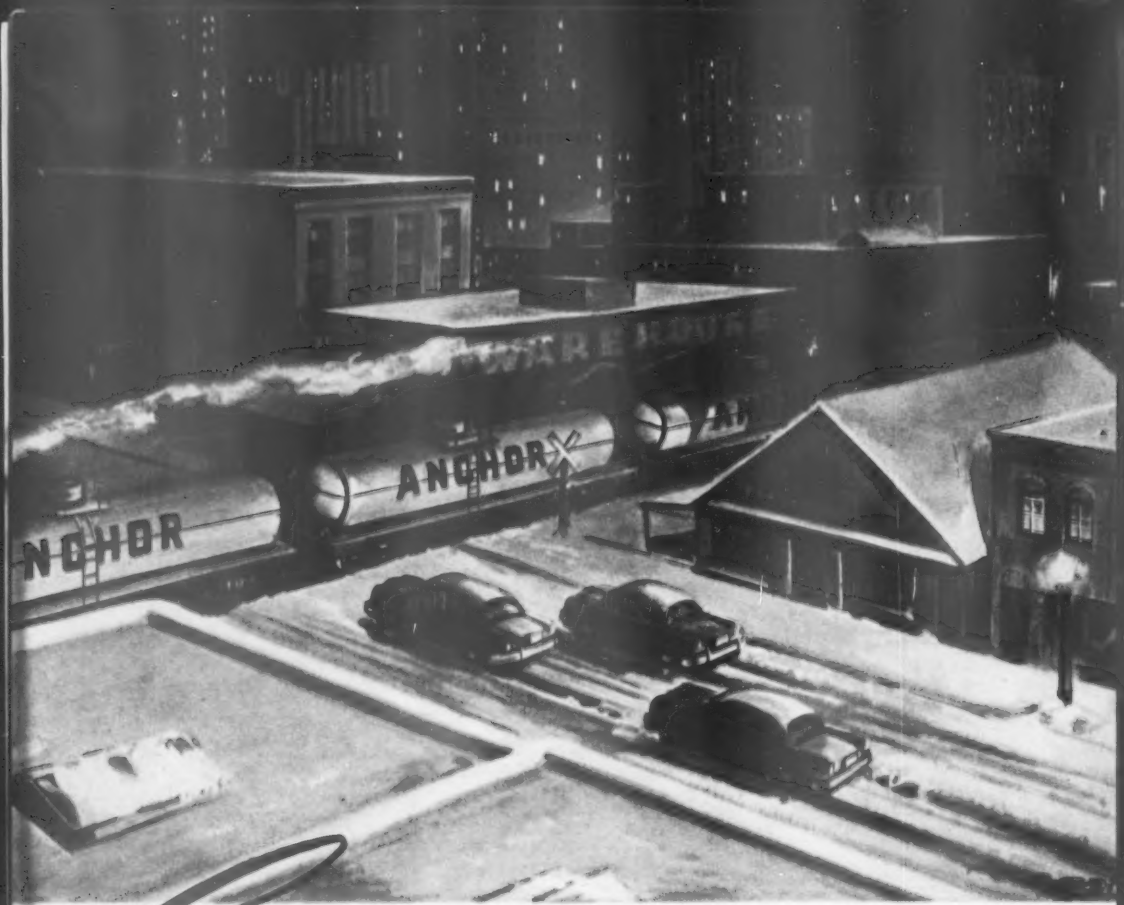
ALL the propaganda that comes from Moscow boils down to the fact that Russia now has at her disposal less than 10 per cent of the world's petroleum output. With the background of what happened in World War II the dictator powers well know that that quantity of oil is hardly more than a start in fueling a major conflict, taking into consideration the required economic support and the minimum oil needs of nearly a half-billion people.

At the same time it should be equally apparent that the controlling responsibility of our country and its friends is to see that this 90 per cent position in petroleum supplies is maintained and protected. This involves not only military defenses but continued improvement in the standards of living made possible by more oil for hundreds of millions of people in their peacetime activities.

Outstanding since the war's end has been the expansion of petroleum facilities in sections where previously they had been inadequate or unknown. The potentialities have only been touched, as reflected in the fact that consumption over most of the world is still only a small fraction of ours.

All this necessitates in turn a new statesmanship among free nations that understands the responsibiliities and opportunities of this dominance in oil as the base for prolonged world peace.

Merry Christmas



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THIS WEEK

REVIEW.—A.P.I. year-end statement chalks up 1952 as another record year—tenth in a row to see a new high in consumption. . . . Increase in domestic consumption set at 3 per cent over 1951. . . . Statement shows U. S. produced 51 per cent of world total during 1952. . . . Total well completions for year set at 46,800, including 24,075 oil wells and 17,950 dry holes. . . . Completions total is 2,250 greater than that of 1951. . . .

INTERNATIONAL.—Right of any country to nationalize its resources endorsed by principal committee of the United Nations. . . . United States loses attempt to amend resolution to provide for compensation for nationalized properties. . . . ¶World-wide oil industry awaits decision in Aden case involving Anglo-Iranian suit against owners of tanker moving Iranian oil. . . . ¶Iranian ambassador in Washington tells American companies they will run no serious risk if they buy and transport oil from Iran. . . . State Department officials confer with British over new plan to settle Iranian dispute. . . . Plan reportedly involves $100,000,000 loan either by United States or some international lending agency. . . .

REINDEER IN THE DESERT would hardly seem appropriate, so Santa in Saudi Arabia uses a steed more adapted to the shifting sand dunes as he passes out toys to American small fry. The children here are from families of American employes in the Dhahran oil facilities of Arabian American Oil Co., a portion of which can be seen in the background. The desert Bedouin who leads Santa Claus' camel on his appointed rounds rests as the gifts are distributed.

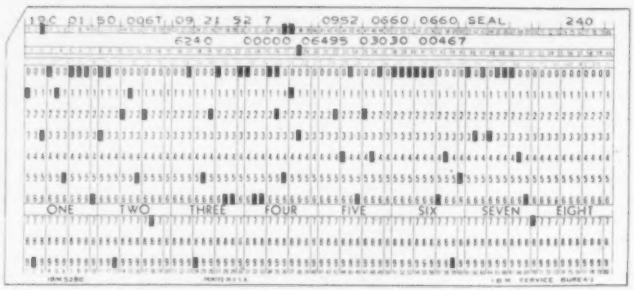
REFINING.—PAD estimates domestic capacity will reach 8,305,941 bbl. daily by the end of 1954. . . . Capacity at end of this year should be about 7,770,560, agency says. . . . ¶Anderson-Prichard Oil Corp. buys controlling interest in Kanotex Refining Co., Arkansas City, Kans. . . . Deal includes 13,000-bbl. refinery at Arkansas City with a new cat cracker placed on stream in September. . . . ¶Union Oil Co. completes big 38,500-bbl. vacuum-distillation unit at its Wilmington, Calif., refinery. . . . ¶Kamloops Refinery Syndicate reveals plans to build a 2,500-bbl. refinery at Kamloops in South Central British Columbia to operate on Alberta crude. . . .

GOVERNMENT.—Grand jury investigation into FTC charges that an oil cartel exists is deferred 2 months to permit new administration to determine its policy on the case. . . . ¶Representative Wolverton indicates he may hold hearings at which industry representatives will be invited to outline their views concerning government agencies which regulate or control their activities. . . . ¶I.P.A.A. survey shows its members want an end to tubular-goods allocations and to all other price, wage, and material controls. . . .

PIPE LINES.—Sun Pipe Line to lay 200-mile, 8-in. products line from its new refinery at Sarnia to serve the London-Hamilton-Toronto markets. . . . ¶Contract is let for three short crude lines to deliver crude from the western terminus of Trans Mountain at Burnaby, B. C., to the Shell refinery at Shellburn, the Imperial refinery at Ioco, and to the loading dock of Trans Mountain at Barnet on Burrard Inlet. . . . ¶Tuscarora Oil Co. completes its 6-in. spur line from Midland to Pittsburgh, Pa., marking one of the final steps in the $10,000,000 modernization program on the company's 350-mile products system. . . .

TRENDS.—Refiners cut crude runs in the first half of December. . . . Total runs for the first 2 weeks in December averaged 348,000 bbl. daily less than in the last 2 weeks of November. . . . Most of the reduction was in Districts 2 and 3, down 122,000 bbl. daily and 162,000 bbl. daily respectively. . . . Runs for the 2 weeks in December were 181,000 bbl. daily or 2.75 per cent greater than for same weeks last year. . . .

ACTIVITY.—Production of crude and lease condensate averaged 6,569,150 bbl. daily for week ended December 13, up 98,000 bbl. daily. . . . ¶Total well completions dropped 113 wells to 778 for the week. . . . ¶Wildcat completions were off 15 wells to 193. . . . ¶Rotary rigs operating in United States gained 71 rigs for the week ended December 15 to 2,781, the highest level since June 23. . . .



PETROLEUM REPORT CARD, SEELIGSON STYLE!—Literally millions of oil-field figures concerning Texas' big Seeligson oil field are now speedily recorded, computed, and filed on "punch card" business forms, by the Seeligson Engineering Committee, San Antonio. This card was especially punched for The Oil and Gas Journal for illustrative purposes. It shows, as compressed and condensed on a typical "punch card," the following information: Well number, company, lease number, well test date, name of formation, producing method, choke size, casing and tubing pressures at test beginning and end, test hours, oil allowable, production during test for oil, gas, and water (barrels), and gas-oil ratio, and flow-string size. Many other classes of oil-field data similarly are reported and computed on other punch cards.

New Brains for Oil

Electronic punched-card computers promise great savings in time, expense in solving variety of intricate problems

Kenneth H. Barnes

COLLEGE STATION, Tex.—A group of 250 petroleum engineers and oil-research personnel received here December 11-12 a historic preview of the new "electronic brain" calculators and punched-card computing systems as applied to widespread types of petroleum operations.

The meeting was the Texas Petroleum Research Committee's Fifth Oil Recovery Conference, and the symposium was "Use of General Purpose Punched Card Computing Systems in Solving Petroleum Engineering Problems."

The sessions were held at A. & M. College of Texas. Officials and study centers of Texas Petroleum Research Committee are located both at Texas A. & M. and University of Texas.

The designation "historic preview" was applied advisedly by many attending the meeting because this was the first concentrated symposium held on petroleum applications of the punched-card business forms and the new electronic calculators.

Dr. H. T. Engstrom, vice president, Engineering Research Associates, Arlington, Va., addressing the group on "Computational Horizons," said, "The impact of these high-speed computing devices upon society has been the subject of much speculation. There are many who feel the close parallel between the varieties of memory in the animal and the problems of constructing artificial memories for machines.

"There are some who feel that these developments are the beginning of a second industrial revolution; that the first industrial revolution replaced the strength and sweat of man by the machine; that the steam shovel made the visible muscular effort of the human of no value. This second industrial revolution, with its automatic factories, may replace the human brain in many of its activities. Therefore, man's effort is becoming decreasingly salable.

"I do not agree. The development of these computers has been a triumph of human ingenuity and their future development and application will provide an even greater challenge to the human mind. I see no other vehicle to which these amazing techniques can be directed toward the betterment of human welfare."

Wide oil scope . . . High spots of the 13 papers covering electronic calculators and punched cards were the following:

. . . Seeligson field data.—R. K. Guthrie, director of the Seeligson Engineering Committee, San Antonio, described how all oil, gas, and water production data, allowables, core-analysis information, drill-stem tests, and many other similar figures are now put on business punched cards, for the big Seeligson field of Jim Wells and Kleberg counties, Texas.

. . . Seeligson proration.—Allowables for monthly oil and gas, and allocation of tank battery oil and gas production to individual wells, are now entirely recorded and computed via punched-card operations at Seeligson.

Over 750 different producing wells, 59 separate zones, and 2,000 bbl. oil allowable per day are involved. Operational know-how developed for this technique was disclosed by J. W. Amyx, senior Seeligson committee engineer.

. . . Sand volumes by punched cards. Net sand thicknesses for an oil field and their well locations on an oil-field map can now be transcribed directly onto business machine punched cards.

Then, by "card programing" an electronic calculator with the appropriate arithmetic formulas, net sand volumes automatically come out as finished computations, in a matter of minutes—or even seconds.

This contrasts with laborious planimetering procedures and subsequent slide-rule calculations which can run into several hours, days, or months of an engineer's time. This paper was also presented by Guthrie and his Seeligson colleagues.

. . . Shortening tank-table computations.—Shell Oil Co.'s crude-oil purchasing division in West Texas is connected to more than 4,200 different lease tank batteries. Each individual tank in this large group, of course, has been mechanically strapped, and has its own set of tank tables.

A great speedup in calculation of crude-oil run tickets recently has been made by Shell in its West Texas division through the use of these punched-card calculations in lieu of arithmetical tank-table computations. Shell's method also eliminates the human errors possible under the former arithmetical figuring. Development of this punched card - electronic calculator procedure was presented by Howard M. Spinning, Shell Oil Co., Midland.

With oil from all the 4,200 tank batteries being run several times a month, computations for corrected oil volumes formerly were extremely time consuming and tedious.

. . . Orifice charts via punched cards. Magnolia Petroleum Co. at Dallas in its natural-gas accounting handles over 14,000 separate orifice meter charts per month. Many tedious multiplications are required for each chart.

Under the new punched card-elec-

tronic calculator procedure developed by A. C. Buchanan, Jr., H. Skinner, and others with Magnolia, the integrator indexes for each chart now are placed on punched cards.

The electronic calculator then is wired and card-programed to multiply automatically the integrator index by the base coefficient and the pressure, gravity, and flow-temperature corrections to yield a final "standard state" volume. Moreover, the "electric brain" calculator does not merely stop with computing these data into standard state volumes—an associated electronic "printing machine" goes ahead and typewrites them in full detail, a complete line at a time, on one of Magnolia's regular gas statement forms.

. . . Research calculations.—Involved calculations frequently are required in many forms of petroleum research. Some have data running into millions of separate figures and millions of individual arithmetical computations. The new electronic calculating machines are very attractive for this as they can perform at speeds ranging from 20 to 20,000 multiplications per second.

Technical papers dealing with electronic computations of such petroleum research subjects as electric log data, nonsteady radial flow of gas, and flash vaporization calculations were respectively outlined by Dr. L. de Witte, Continental Oil Co., Ponca City, Okla.; Dr. J. S. Aronofsky, Magnolia Petroleum Co., Dallas; and D. G. McCarty, Humble Oil & Refining Co., Houston.

The cards' history . . . Background behind modern business machine punch cards and the new high-speed electronic calculators or "electric brains" was detailed to the Texas A. & M. conference by Omar Harvey, San Antonio, and Paul Fullerton, Tulsa, both of International Business Machine Corp.

Harvey said the development of punched-card systems actually began way back in the 1880's when Dr. Hermann Hollerith in Washington, D. C., recognized the need for and conceived the idea of a mechanical means of tabulating the United States census.

During the first half of this century, punched cards found their way into some phase of almost every industry. Originally they were designed for accounting functions, and the name "accounting machines" has been retained in some nomenclature. However, the development of the calculating punch and other high-speed computers with punched card or magnetic type input and output has now opened wide paths for speeding routine petroleum operations and technical computations.

ELECTRONIC BRAIN TRUST!—Authors at the recent Texas A. & M. symposium on "electronic brain" ultra high-speed calculators, for both routine and research type petroleum computations included, left to right: W. P. Schultz, Humble Oil & Refining Co., Houston; D. C. McCarty, Humble, Houston; P. W. Fullerton, International Business Machines Corp., Tulsa; Omar Harvey, I.B.M., San Antonio; A. C. Buchanan, Jr., Magnolia Petroleum Co., Dallas; W. F. Blair, Shell Oil Co., Midland, Tex.; H. M. Spinning, Shell, Midland; H. Skinner, Magnolia, Dallas; W. D. Bell, Telecomputing Corp., Burbank, Calif. Other authors at the "electric brain" sessions were: Dr. L. de Witte, Continental Oil Co., Ponca City, Okla.; Dr. J. D. Porter, Massachusetts Institute of Technology, Cambridge; Dr. H. H. Rachford, Jr., and C. E. Williams, Jr., Humble, Houston; Dr. J. S. Aronofsky and R. Jenkins, Magnolia, Dallas; Dr. H. T. Engstrom, Engineering Research Associates, Arlington, Va.

Oil applications . . . In routine hand-to-hand "paper-handling" within an oil company, a single fact ordinarily is used many times in various reports, studies, and problems. Such paper handling or manual system requires the repeated copying of the same data.

The modern punched-card system, in contrast, requires that data be copied or transcribed only once. This is accomplished by the electric card-punching machine. When transcribed once onto punched cards, no further copying is necessary. Thereafter, all further work with the cards is performed automatically by electronic machines.

Thus for an oil company employing the new techniques, all of its various reports now can be transcribed into punched holes on cards and these cards of data "worked" at high speed, automatically.

The punch card . . . This simple small rectangle of cardboard has 80 horizontal columns, each of which will accommodate a single alphabetic or numeric character. Numeric recording of a single digit requires only one punch in a column, two punches for a single alphabetic character.

Into these cards the oil companies are now punching all types of factual data—core analysis, drill-stem tests, production test records, geological and geophysical data, chemical compound data, etc.

To follow the rule of uniformity, the 80 columns are grouped to provide a specific space on the card for specific data. For example, a card designed for production test records has "fields" (columns) designated for company, lease, and well numbers; date of test; duration of test; choke size; oil, gas, and water production, etc. Numeric codes are assigned to such variables as company, lease, and wells, to abbreviate the punching and conserve space.

. . . Verification.—Punch-card data can be positively checked for accuracy, in an operational procedure similar to the punching itself, on an electric verifier.

. . . Classifying or sorting.—The arranging of punch cards into related classifications or into a desired sequence can be accomplished automatically and at high speed.

Manual distribution for various arrangements of data is completely eliminated. For example, a file of the punch cards of the Seeligson Engineering Committee on core analysis that is maintained in company, lease, and well-number sequence can be rearranged or sorted by permeability range at a rapid rate.

. . . Summarizing.—Data classified in desired groups can be rapidly summarized or recapped for finished reports, via the electric accounting machine. Cards fed into this unit are read, listed, distributed by subclassifications, added, subtracted, and totaled automatically. Data can be printed on reports from this machine in any desired sequence—regardless of the original punching arrangement.

The punched-card system, together with digital computers, Harvey and Fullerton reported, have now advanced to the point that they are being economically applied by many oil companies not only to speed data compiling and accounting but also to relieve a great deal of engineering and technical talent from tedious computation.

The Seeligson setup . . . Engineers are often burdened with large volumes of

SEELIGSON POOL ENGINEERING COMMITTEE.—This San Antonio group presented three important and pioneering papers on application of "electronic calculators—punch cards" to petroleum engineering problems, at the Texas Petroleum Research-Texas A. & M. College meeting. From left to right are: R. K. Guthrie, R. Martinez, J. W. Amyx, A. R. Moore, W. M. Robinson, L. Kotara, R. H. Wallace.

clerical detail while performing interpretative work.

For instance, when interpreting an electric log, the following factors are determined: top and base of sand converted to depths below sea level, gross sand interval, net oil sand, net gas sand, total net sand. In addition to interpreting and reading depths from the log, the determination of these quantities requires between 5 and 15 subtraction operations and 5 to 10 additions. These arithmetic operations may be performed by the engineer or geologist as the log is interpreted, or they may be assigned to clerical help.

The above procedure was before "PC-EC," or punched cards-electronic calculators. R. K. Guthrie and his Seeligson Engineering Committee have now completely mechanized such computations. In a recent application by the Seeligson group, two men each examined a total of 11,000 sand sections in 750 electric logs, recording well and zone identification with depths. The data were punched into cards, verified, and approximately 300,000 arithmetic operations performed by machine to obtain the required data from each man's interpretations.

The two sets of interpretations were then automatically merged and compared by machine, requiring 66,000 more arithmetic operations. The Seeligson data (now 250,000 numbers) were then listed, with significant differences highlighted.

A third man reviewed the significant differences and decided which interpretation was the more reasonable. The final interpretations were then averaged (165,000 arithmetic operations) and lists printed both by reservoir and by well for reference files and for the draftsmen. By Seeligson's new "PC-EC" method, all this took only a minor fraction of the time to do it by hand.

Electric-log computations . . . Resistivity departure curves depict the relation between apparent resistivities measured by electrical surveys in drill holes and the actual geometric distribution of formation resistivities. Recent instrumentation advances posed the problem of computing a very detailed and complete set of such departure curves to give direct solutions for the in-place resistivities.

Dr. L. de Witte, of Continental Oil Co., recently employed Massachusetts Institute of Technology's famed $10 million "giant brain" which has the nickname Whirlwind I, to make quickly an extensive series of such complex computations. The analytical expression from which Dr. de Witte calculated the departure curves is an extremely complicated solution of Laplace's equation in cylindrical coordinates, and the computations require integration of the product of a combination of modified Bessel functions and a cosine.

Whirlwind I is a high-speed digital computer having an electrostatic memory of 1,024 words of 15 binary digits plus a sign digit and an accumulator of similar length. More than 20,000 additions or more than 15,000 multiplications can be performed per second.

Conoco's Dr. de Witte, using Whirlwind I at M.I.T., evaluated simultaneously the apparent resistivities for 22 different well-logging spacings. The computation of these 22 points for one departure curve required only 10 minutes of machine time, although it involved some 10 million separate arithmetic operations.

A special editorial section wherein all of the Texas A. & M.-Texas Petroleum Research Committee papers on "High Speed Business Machines—Punched Cards—Electronic Calculators" will appear, is being scheduled for The Oil and Gas Journal issue of February 2, 1953.

Industry Briefs

DALLAS.—Western Production Co. has purchased 39 producing wells in Bartlett and Crow fields, west of Anson, in Jones County. Consideration was reported to be $1,200,000. Sellers were Jones & Stasney, Onyx Oil Co., and Ungren & Frazier, Abilene; and Staley Oil Co., Wichita Falls.

AUSTIN.—A catalogue of films for the petroleum industry has been completed and is now being distributed by the University of Texas Visual Instruction Bureau. It may be obtained by writing the bureau. The catalogue lists several hundred films available to the oil industry on a loan or rental basis.

LOS ANGELES. — Dow Chemical Co. in January will start construction of a new styron plant at Torrance, reported cost of which is approximately $2,000,000.

SAN DIEGO.—San Diego Corp. has been formed to develop oil-land holdings of Consolidated Vultee Aircraft Corp. The holdings are in Colorado, Kansas, Montana, Nebraska, New Mexico, and Oklahoma. The aircraft company said it is transferring operating funds to the new company and, in return, issuing San Diego Corp. stock to Consolidated Vultee shareholders. The aircraft company intends to retain stock ownership of 1½ per cent or less in the new company, it said.

CLARKSON, Ont. — Employes of British American Oil Co.'s refinery here have completed 1,000,000 manhours of work without a lost-time injury for the second time in the past 2 years and the fifth time since the refinery went on stream in 1943. In accordance with company custom, each of the 600 employes received a check for an extra day's pay in recognition of his contribution to the company's safety program.

LOS ANGELES.—Zephyr Oil Co. has been granted a lease by the Los Angeles City Council on about 11 acres of semiproved property underlying Los Angeles Harbor on the southwest edge of Wilmington field. The company plans to drill about 11 wells, slanted from Harbor property. The lease, for a minimum of 5 years and not to exceed 10 years, gives the city a 25 per cent royalty. Drilling of the first well is to be started immediately, according to W. I. Barcus, Zephyr president.

How to Get Ahead...

Engineers don't become executives on technology, alone; sound knowledge of human relations needed, A.I.Ch.E. told

Gerald L. Farrar

CLEVELAND.—Engineers must learn the importance of unpredictable and illogical factors in their relations with other people, in the opinion of R. L. Demmerle, assistant director of administration of General Aniline & Film Corp., New York.

Demmerle addressed members of the American Institute of Chemical Engineers at the Institute's annual national meeting here. Nearly 2,000 engineers attended the December 8-10 sessions.

Demmerle introduced a four-paper human-relations discussion which was the best attended and most enthusiastically received session of the meeting.

Engineers in management . . . Two major trends in the processing industries emphasize the need for this recognition, he said: (1) the movement of technically trained men into key managerial posts where the principal responsibility is the direction of people, and (2) the increased interest of nontechnical management groups and the investing public at large in the processing industries. This development makes it necessary for technical men to become the "ambassadors" of industry to the lay world.

In some ways the discipline of the technical man's formal training works to his advantage in his dealings with people. For example:

. . . He is in an enviable position to inspire trust. He is creative. He hates waste.

. . . He is continually trying to push back the boundaries of knowledge. The public has great respect for such a man.

. . . He is honest, almost to the point of brutality. People learn they can depend on what he says to be literally true.

. . . He has prestige that accompanies those who work with abstract things.

On the other hand, Demmerle said, some of the attitudes of the technical man stand in his way in his dealings with people.

. . . He is dogged in his thinking and thus is impatient when confronted with people whose thinking processes are not as well ordered and disciplined as his.

. . . Accustomed to making decisions based on fact, he lacks sympathy with the emotionally based inconsistencies of human behavior. All too often his feelings about these matters are not in the least hidden.

Requisite qualities . . . Technical people seeking to improve their relationships with other people should know their "MAP" (motivation, ability, personality) characteristics, said R. S. Schultz, director of Industrial Relations Methods, Inc., New York. Motivation and ability of most engineers are superior, and attention should be focused on personality traits, he said.

There are five ways, he said, to increase your success in dealing with other people and to otherwise enhance your professional development:

. . . Self-perception. Size up yourself; admit your strengths and weaknesses. Then do something about it. Obey your serious impulses. Be as intelligently inquisitive about things outside your field as you are your work.

. . . Egocentrism. Appeal to the other fellow's selfish interests. The individual's first reaction usually is, "What's in it for me?" Pitch your discussion around this question, as much as possible.

. . . Empathy. Put yourself in the other fellow's place. How would you, if you were he, interpret changes in the status quo. Don't expect him to understand you immediately. Give adequate explanation. Be prepared to discuss the situation calmly, even in the face of unreasonable resistance.

. . . Imitation. Observe how successful supervisors deal with people. Analyze their approaches and the reactions of the people who work for them. Adapt these methods to your own way of doing things.

. . . Practice. Be always aware of the other fellow and his feelings. Apply your findings to off-the-job situations as well.

Group discussions . . . The engineer when faced with a human-relations problem usually becomes emotionally involved and disregards his training in analysis. He looks for a scapegoat, someone to blame, Paul Pigors, professor of industrial relations at Massachusetts Institute of Technology, said.

The first step should be an impersonal analysis of the factors involved. When problems exist between the line and staff members of an organization, the points of disagreement should be frankly and honestly admitted to provide the basis for further discussion. Once these factors have been stated, it will often be found that the problems are not as serious as had first been thought.

In continuing the discussions, the engineer or technical man should keep in mind these aids to the promotion of harmonious relationships . . .

. . . When talking to other people, particularly those with which you have some disagreement, ask yourself, "What speaks in the minds of these people when I speak, besides what I say."

. . . Then try to understand the point of view of the others and see how incompatabilities can be straightened out.

. . . Don't expect the others to take steps to resolve the difficulties. Cultivate the attitude that it is strictly up to you. This doesn't mean that you will have to make all the concessions.

The first discussion of problems between groups is very important, Pigors said. Once a session is completed, and others are scheduled, it is obvious to both sides that negotiations are continuing, in spite of the fact that disagreeable things have been said. The solution, though perhaps not immediate, is in sight.

How to convey ideas . . . The use of a technical terminology that is foreign to the lay listener or reader must be avoided at all costs, said Phillip Swain, editor of Power magazine, McGraw-Hill Publishing Co., New York.

Most people don't know the engineering language; therefore the engineering writer or speaker must use language they do know, he said.

Don't use "fancy talk"—long words, long sentences, long paragraphs, passive voice, past tense, or abstract nouns. Use the personal pronouns when necessary to convey a thought simply and directly. Use present tense and action words wherever possible.

One engineer, Swain said, wrote as follows: "It is inadvisable to operate belting at excessive peripheral velocity." After puzzling over this expression, mechanical-engineer Swain interpreted as follows: "Don't run belts too fast."

The technical man must go much more than half way in his attempts to meet the layman on a common sematic ground. In such instances, the technical man must walk a narrow path between the alternate dangers of being too sparse in his technical explanations or of boring and losing the listener in a flood of extraneous data.

Usually the engineer is more guilty of the latter fault, he said.

The type and capabilities of the individual person or audience must be ascertained and never forgotten during the transmission of an idea.

Williston Agreement Reached

BILLINGS. — Shell Oil Co. and Northern Pacific Railway Co. have

concluded a joint operating agreement to develop approximately 6,000 acres of the railways lands in Fallon County, Montana, in the Williston basin.

This is the first agreement concluded under Northern Pacific's new policy of joint development rather than straight leasing.

Shell is to bear all exploration expenses until commercial production is found. After that Northern Pacific will pay 39 per cent of all development and operating costs and will receive 39 per cent of oil and gas production from its lands. The lands are to be placed under a unitization agreement together with other leases, and the railway will receive a royalty of 14 per cent on production allocated to its lands in participating areas of the unit agreement.

Previously Northern Pacific has leased some tracts on a straight one-eighth royalty. The new policy is designed to give the railway a greater share of production in return for financial participation in development.

Record Year in Oil

A.P.I. year-end report shows 1952 chalked up all-time highs in production, consumption, and capital expenditures

NEW YORK.—All-time peaks were reached this year in production, processing, and distribution of petroleum, Frank M. Porter, American Petroleum Institute president, said last week in presenting the Institute's year-end report. This represents the tenth consecutive year that the American people have consumed record volumes of petroleum products.

Domestic demand approximated 2,650,000,000 bbl. and total demand including exports topped 2,800,000,000 bbl. The domestic figure represents an increase slightly more than 3 per cent over last year's record consumption.

A new record in industry investment was also chalked up, said Porter, citing the capital expansion program estimated at more than 4 billion dollars, an increase of nearly 25 per cent over last year. Capital expenditure since the end of the war is now approaching the 20-billion-dollar mark.

Supplies . . . The A.P.I. estimate of production of liquid petroleum in 1952 is 2,516,000,000 bbl., an increase of 66,000,000 bbl. over 1951. The figure includes 2,295,000,000 bbl. of crude oil and 221,175,000 bbl. of natural-gas liquids. Total natural-gas production increased an estimated 800 billion cubic feet over last year to reach 10.5 trillion cubic feet.

For liquid petroleum 1952 total demand averaged 7,666,000 bbl. daily and supply 7,823,000 bbl. daily. Corresponding figures for 1951 were: Demand, 7,455,000, and supply, 7,556,000 bbl.

The A.P.I. made this breakdown of the 1952 supply figure, in barrels daily: crude production, 6,271,000; natural-gasoline production, 604,000; imports (all oils), 948,000; domestic demand, 7,240,000; and exports (all oils), 426,000. Corresponding figures for 1951 are 6,149,000; 564,000; 843,000; 7,032,000; and 423,000.

Product output . . . To meet the record demand U. S. refiners increased capacity to 7,613,000 bbl. per day and processed 2,436,000,000 bbl. of crude during the year. Of the refinery capacity, 7,585,100 bbl. per day was considered operable at year's end.

The increase of more than 66,000,000 bbl. in crude runs over last year was cited as a remarkable achievement by Porter in view of the fact that many refineries were shut down for varying periods late last spring due to labor difficulties.

Motor fuel production rose to 1,187,000,000 bbl., an increase of slightly more than 4 per cent. This equals 940 gal. for every one of the 53 million motor vehicles in this country.

Production of gas oil and distillates jumped 10 per cent to 524,250,000 bbl. Residual fuel oil showed a slight decline from 469,000,000 bbl. last year to 452,000,000 in 1952. Combined total for all fuel oils was 976,400,000 bbl., a new record.

Drilling . . . Despite higher costs and shortages of critical materials, particularly oil-country tubular goods, oil men carried out their busiest drilling program in history to drill an estimated 46,800 wells, 2,250 more than last year.

Of this total 17,950 were dry holes. No estimates are yet available on proved reserves discovered during the year, but in view of the record drilling program, proved reserves were undoubtedly increased, said Porter.

Other figures . . . Highlights in the detailed year-end statement included these figures:

. . . World production of crude oil during 1952 totaled 4,500,300,000 bbl., with the United States accounting for 51 per cent or 2,295,175,000 bbl.

. . . Year-end stocks of crude oil and products are estimated at 691,609,000 bbl. Crude oil in storage at the end of 1952 is estimated at 285,750,000 bbl.

. . . Well completions in 1952 totaled an estimated 46,800, including 24,075 oil wells, 3,325 gas wells, 17,950 dry holes, and 1,450 service wells.

. . . The index of wholesale prices for crude oil and products was placed at 109.4, compared with an all-commodity index of 111.7.

. . . The average retail motor-fuel price at the year's end was placed at 20.25 cents a gallon. With local, state, and federal taxes averaging 7.32 cents per gallon, the total average cost to the consumer was 27.57 cents.

Purchase Offer Made

SHREVEPORT.—Natural Gas & Oil Corp. has offered to buy all the stock of Westgate-Greenland Oil Co., Kansas City, for $6 a share. Westgate-Greenland has about 1,200,000 shares outstanding. The offer was conditioned upon the ability to acquire at least 51 per cent of the stock.

Westgate-Greenland operates oil-producing properties in Oklahoma, Texas, Kansas, and California. It has about 190 producing oil wells.

Natural Gas & Oil Corp. was formed in 1950 by Mississippi River Fuel Corp. as an exploration and production company.

Gas-Import Prevention Asked

PITTSBURGH.—Prevention of imports of natural gas from Canada was called for here last week by Tom Pickett, executive vice president of the National Coal Association.

Pickett, addressing the Coal Mining Institute of America, also asked for restriction on imports of residual fuel oil. An immediate responsibility of the incoming national administration, he said, is to change national policies "prejudicial to coal's position in competitive fuel markets."

Firms Win Antitrust Suit

AUSTIN.—Ten oil companies won the first round here last week in a suit by the state charging violations of the antitrust laws in gasoline pricing.

A district court judge dismissed the state's charges after sustaining exceptions outlined by the companies. The suit was filed in February 1949.

Companies involved were Arkansas Fuel Oil Co., Gulf Oil Corp., Cities Service Oil Co., Continental Oil Co., Humble Oil & Refining Co., Magnolia Petroleum Co., Standard Oil Co. of Texas, Sinclair Refining Co., The Texas Co., and Phillips Petroleum Co.

The suit had charged the companies with conspiring illegally to raise tank-wagon gasoline prices after price controls were lifted in 1946.

Cartel Probe Deferred

Judge Kirkland postpones investigation until March 16 in frank move to allow new government time to decide policy

WASHINGTON. — The grand jury investigation of the alleged international oil cartel was deferred last week for another 2 months to give the incoming Republican administration time to decide its policy with respect to the case.

Federal District Court Judge John R. Kirkland postponed until March 16 the deadline previously set for January 12 for submission to the grand jury of the foreign documents sought under the controversial Department of Justice subpoena.

In other court actions, the Government and the oil companies involved both claimed limited victories in the sparring preliminary to the grand jury investigation:

1. The Supreme Court refused to review a decision by Judge Kirkland denying the companies' motion to kill the investigation or transfer it to New York.

2. Judge Kirkland quashed the Department of Justice subpoena requiring Anglo-Iranian Oil Co. to submit overseas documents.

3. Companies other than Anglo-Iranian were given until January 12 to submit all documents available in the United States bearing on the inquiry and until February 2 to submit the response of foreign governments to applications for release of documents involving their interests.

4. The Netherlands Government advised the State Department it would not permit any documents to be removed from the Netherlands for use in the investigation.

Considered the most important of these developments were the dismissal of Anglo-Iranian from the case and the further postponement of the grand jury investigation.

Reaction to ruling . . . In some quarters the view was expressed that the dismissal of Anglo-Iranian was a "break" which might foreshadow the folding of the investigation, since one of the principal respondents now was out of the picture.

But whether the company actually is out probably will have to be determined by a higher court since Leonard J. Emmerglick, special assistant to the Attorney General in charge of the case, said he would appeal Judge Kirkland's decision after the judge turned down a request for another session to hear new evidence.

The "new" evidence, reportedly, was a letter from the State Department to the Attorney General purportedly showing that the British Government had not claimed immunity for Anglo-Iranian and showing also that the department within the past year set new standards for determining what constitutes a claim of immunity by a foreign government.

The subpoena against Anglo-Iranian was quashed by Judge Kirkland on grounds that, since the British Government had a better than 52 per cent interest in the company, it has "sovereign immunity" from prosecution in this country.

"The consequence of the successful prosecution of Anglo-Iranian here would in reality be to charge and find the British Government guilty of violating a law of the United States which imposes penalties," he said in his order.

Applause for delay . . . Postponement of the investigation also was considered a break for the companies, since there is a general feeling that the new administration may not be as eager to tear the oil industry down as is the present government.

During the argument before Judge Kirkland, Emmerglick, in replying to contentions by company counsel that the Government's several recent moves against the oil industry were jeopardizing our national interest abroad, read a letter written by President Truman as evidence that our foreign policy is back of the department.

The letter, marked "confidential," was sent to the heads of the State, Interior, Commerce, and Defense Departments and the Federal Trade Commission by the President last June 23. It stated:

"I have requested the Attorney General to institute appropriate legal proceedings with respect to the operations of the international oil cartel. I should like for you to cooperate with him in gathering the evidence required for these proceedings."

Judge Kirkland stated frankly that his postponement order was aimed at giving incoming President Eisenhower an opportunity to review the case.

"The court is compelled to take cognizance of the fact that a new administration will take office January 20," he said. "I think it proper to give it time to make another survey to make sure that this is the policy the Government is pursuing."

Companies criticized . . . In handing down his rulings setting dates for the

Oil Men in Executive Training Course

Operating men of the petroleum industry who attended the ninth session of the University of Pittsburgh's course on Management Problems for Executives are shown here with one of their instructors, C. L. Van Sickle, of the University's School of Business Administration. Seated, left to right, are George W. Oliver, Southwest Texas division superintendent for Humble Pipe Line Co., Corpus Christi; Andre Antoine Dubois, refinery superintendent for Esso Standard Oil Co., Paris; Jacob Nuveen, chief of the ships performance analysis section, Esso Shipping Co., New York; and Pablo Enrique Pareja, assistant general manager and director of Esso Colombiana, S. A. Standing are Stanley Fullerton, area consultant for Standard-Vacuum Oil Co., New York; Emmett C. Wells, Jr., assistant superintendent of the eastern division of Carter Oil Co.; Edward R. Cook, maintenance superintendent, Bahrein Petroleum Co., Ltd., New York; Henry Parrott Byrd, general sales manager, Philippine division, Standard-Vacuum Oil Co., New York; Richard Williams Camp, operations and engineering manager, Japan division, Standard-Vacuum Oil Co.

submission of the documents sought by the department, Judge Kirkland was critical of the companies, asserting that they had not made adequate attempts to comply with his order of November 10 directing them to endeavor to get the consent of the sovereign authority for removal of documents from foreign countries.

He again ordered company attorneys to make an attempt in good faith to obtain the documents abroad and said if requests are refused the reasons must be certified and delivered through diplomatic channels and the court must be informed by February 2 of the response of foreign governments.

If consent is refused by foreign governments in "unambiguous and clear terms," he added, a preliminary hearing will be held on the method of arguing the foreign laws involved and arguments will be heard March 2.

Review refused . . . The Supreme Court's refusal to review the lower court decisions denying the companies' motion to kill the investigation or transfer it to New York was announced, as is usual in such cases, in a brief order which did not go into the merits of the case.

The review had been sought by California-Texas Oil Co., Ltd., Socony-Vacuum Oil Co., Inc., Standard Oil Co. of California, The Texas Co., and Arabian American Oil Co. in a petition filed October 29.

The companies contended they could not secure fair and impartial consideration from the District of Columbia grand jury, 14 of whose 23 members were government employes, 8 of them in agencies directly interested in the case.

PAD Refining Estimate

Agency says domestic capacity at year's end will be about 7,770,560 bbl., 2.4 per cent higher than A.P.I. estimate

WASHINGTON.—Domestic refinery capacity now is expected to reach 8,305,941 bbl. daily by the end of 1954, an increase of close to 1,000,000 bbl. in a 3-year period.

Results of a survey started last August were made public last week by the Petroleum Administration for Defense. They place the expected effective capacity at the end of this year at 7,770,560 bbl. daily—somewhat higher than the 7,585,100 bbl. figured by the American Petroleum Institute *(The Oil and Gas Journal, December 15, page 85).*

Salient figures in the survey were reported by Deputy Petroleum Administrator J. Ed Warren as follows:

. . . **Total cat cracking capacity** is scheduled to increase from 1,991,744 bbl. daily at the beginning of 1952 to 2,497,910 bbl. daily at the beginning of 1954 and 2,649,471 bbl. at the beginning of 1955.

. . . **Total cat reforming capacity** for all catalytic reforming, for production of gasoline, chemicals, and solvents, will rise from 115,585 bbl. daily at the beginning of 1952 to 316,953 bbl. at the beginning of 1954 and 420,853 bbl. a year later.

. . . **Recovery of propylene** at refineries is scheduled to increase from 69,494 bbl. daily at the beginning of 1952 to 92,669 bbl. by 1954 and 100,395 bbl. by 1955.

. . . **Recovery of butylenes** will rise from 127,511 bbl. daily last January 1 to 153,718 bbl. by 1954 and 162,953 bbl. by 1955.

. . . **Recovery of isobutane** from refineries is scheduled to increase from 109,370 bbl. daily at the beginning of 1952 to 133,590 bbl. by 1954 and 146,592 bbl. by 1955.

Warren explained that the figures were obtained through a questionnaire sent to 237 refiners who operate about 350 refineries. The information was analyzed by the Military Fuels Technical Advisory Committee and adjustments made in the data to bring them into conformity with Bureau of Mines statistics and information available to PAD through applications for construction of facilities.

The figures developed by PAD were not based on the theoretical maximum capacity of the refineries but on practical capacity, allowing time for repairs and other unavoidable shutdowns.

Details of the industry's expansion program through 1954 are shown in the accompanying table.

Process Unit Capacity of U. S. Refineries†

(Barrels per calendar day)

	Capacity after assured projected expansions			
	Jan. 1, 1952	Jan. 1, 1953	Jan. 1, 1954	Jan. 1, 1955
Rated crude capacity‡	*7,358,862	7,770,560	8,156,381	8,305,941
Catalytic cracking capacity:				
Fresh feed	1,991,744	2,190,717	2,497,910	2,649,471
Total feed	2,394,744	2,675,035	3,040,728	3,264,518
Conversion—per cent on fresh feed	54.6	55.1	55.4	55.8
Catalytic reforming capacity:				
For gasoline, feed	80,380	124,728	235,128	339,028
For chemicals and solvents, feed	35,205	55,725	81,825	81,825
Total light ends recovery from all sources:§				
Propylene	69,494	81,730	92,669	100,395
Butylenes	127,511	142,953	153,718	162,953
Isobutane (refinery sources)	109,370	120,064	133,590	146,592
Isobutane (normal outside sources)	20,239	20,636	19,618	20,829

*Does not agree exactly with Bureau of Mines figure due to being later information. †Capacity means the maximum daily average throughput obtainable with allowance for normal downtime for repairs, etc. ‡As reported in Bureau of Mines annual survey, "Capacity of Refineries and Cracking Plants." §Recoverable in a suitable stream for possible use as alkylation feed or as chemical feed.

Oil Lobby Attacked

Propaganda charge levied at Caltex, O.I.I.C. by FTC

WASHINGTON.—The Oil Industry Information Committee "or some other propaganda source" was linked with the California-Texas Oil Co. by Federal Trade Commissioner Stephen J. Spingarn last week in what he termed an "inspired propaganda lobby of the oil industry" against the commission's oil cartel report.

Spingarn specifically attacked Caltex for the pamphlet containing editorials critical of the commission which he said had gone to "government officials and molders of public opinion" throughout the United States and 67 foreign countries.

"I don't mind being hit a little below the belt but in this they're way down below the ankles," the commissioner asserted in revealing that he had written identical letters to President-Designate Eisenhower, President Truman and the chairman of the Democratic and Republican national committees complaining of the "conduct of citizens toward

their Government in their dealings with it."

Law proposed . . . Spingarn expressed his support of a proposal by Chairman J. Haden Alldredge of the Interstate Commerce Commission for a law conferring upon the independent commissions the power to punish for contempt and said, in his opinion, the Caltex pamphlet would be a good example for contempt proceedings.

"I certainly do not object to any criticisms which the oil companies or anyone else may wish to make on the merits against the oil report," Spingarn said, renewing his challenge to the companies to seek a hearing "on the merits of the matter" before the Senate Small Business Committee when Congress convenes.

Spingarn, whose term on the commission expires next September and who has said he would not accept reappointment, even if offered, said he is embarking on a one-man campaign to get public sentiment behind the commission.

"I am just beginning the fight," he said. But, he added, "If I don't get support it will probably die out."

Major-Product Exports Dip

WASHINGTON.—Exports of major products dropped to an average of 210,400 bbl. daily during the week ended November 21 from 259,000 bbl. daily in the preceding week, according to statistics compiled by the Petroleum Administration for Defense.

Shipments of motor gasoline and residual increased over the week ended November 14, but exports of the other three products were sharply reduced.

Details of the week's movement, compared with the preceding week, and averages for the four weeks ended November 21 are shown in the accompanying table, in thousands of barrels daily.

	Week ended Nov. 21	Nov. 14	Average 4 weeks
Aviation gasoline	34.1	45.3	38.9
Motor gasoline	47.4	39.6	48.8
Kerosine	...	5.0	5.8
Distillate	85.2	141.9	104.2
Residual	43.7	27.2	31.4
Total	210.4	259.0	229.1

SEC Estimates Oil Outlay

WASHINGTON.—Expenditures of the oil industry for new plants and equipment in the first quarter of next year will total $678,000,000, it was

WATCHING WASHINGTON

Bertram F. Linz

What Is PAD's Future?

The Interior Department's defense agencies, including the Petroleum Administration, are disturbed over shifts in policy that may develop when Gov. Douglas McKay takes over next month.

PAD officials aren't concerned over the political aspects of the change in administration. The agency has been operated by Secretary Oscar L. Chapman on a nonpolitical basis—Bruce K. Brown is a Republican and J. Ed Warren is a "Texas Democrat." The jobs aren't exactly political plums and it has been difficult to get men to fill them, even without regard to political affiliation.

What is of concern is the uncertainty over future over-all policy. PAD was set up on a temporary basis and the industry was assured that as soon as the emergency was over it would be disbanded. That is all right with PAD officials, but what they fear is that the agency may be closed down before the Defense Production Administration and National Production Authority, which control the distribution of materials, go out of business.

So long as the defense effort continues, they said, PAD should be kept going if the industry is to be protected.

So far, McKay has been unable to come to Washington to look over his new realm. Chapman has been in telephonic contact with him, but no one has had a chance to explain the workings of the agencies or the department bureaus, and PAD officials believe that oil men acquainted with the Oregon governor could do themselves and their industry some good by explaining the unique position of PAD in the defense structure.

High-Cost Rubber Back

Demand for synthetic rubber is growing so fast that the Reconstruction Finance Corp. is running into a butadiene supply problem.

To meet a prospective shortage of petroleum-based butadiene the RFC is returning two alcohol lines at its plant at Kobuta, Pa., to operation this month and has ordered the reactivation of two alcohol lines at its synthetic-rubber plant at Louisville, Ky. These lines are expected to permit an increase of some 10,000 tons of rubber a month.

The rubber industry recently estimated it would require 163,373 long tons of GR-S synthetic in the first quarter of 1953. It has since revised its estimate upward, and there are indications that demand will increase steadily next year.

Butadiene made from alcohol is much more expensive than that produced from petroleum and the RFC's alcohol facilities have been closed down for some time because the petroleum-butadiene facilities were adequate to meet the demand for rubber. When they were in operation, RFC encountered difficulty in securing alcohol and had to buy large quantities abroad, and will soon be buying from domestic producers again.

Scaling Down the Goals

Petroleum Administration for Defense officials have abandoned all hope of carrying out their 18-month drilling program of 50,000 new oil and gas wells this year and 55,000 in 1953.

Present indications are that this year's drilling will be something like 46,200 wells, nearly 4,000 short of the goal. On the basis of this experience it is now estimated that new wells drilled next year will run between 47,000 and 48,000, or at least 7,000 under the target figure.

The present cushion of shut-in production is about 800,000 bbl. daily. That is not too satisfactory, and it is hoped it will be increased even with the slower drilling program.

The cut-back in drilling is due to a combination of factors—high cost, lack of tubular goods and fluctuations in demand for products among them.

PAD officials say the important thing is that in the event of war drilling should be continued at its present rate or better. They point out that the number of wells drilled was sharply cut back in the first 2 years of the last war with the result that in the closing days of the conflict oil supply had become a serious problem.

estimated by the Securities and Exchange Commission last week.

The first-quarter investment will be $186,000,000 above the same period in 1952 but $43,000,000 less than for the current quarter, the commission said. Both the present and coming quarters, however, will be somewhat higher than expected, because the steel strike cut actual expenditures for the third quarter below those anticipated and the carryover is reflected in the figures for the two subsequent quarters.

The commission estimated that the expenditure in new petroleum facilities will amount to $2,494,000,000 this year, about 25 per cent more than was spent in 1951.

Views on Controls

Most I.P.A.A. members for early end to allocations

WASHINGTON.—Independent producers want tubular-goods allocations eliminated "as early as is practicable."

They feel that all price, wage, and material controls are unnecessary and harmful and should be terminated as soon as possible, Deputy Petroleum Administrator J. Ed Warren was told last week by Charlton H. Lyons, president of the Independent Petroleum Association of America.

Lyons disclosed in a letter to Warren that a poll of the I.P.A.A. membership prior to the conference on tubular-goods control December 8 showed 424 producers favoring immediate decontrol and only 162 opposing it at this time.

Most of those opposing immediate decontrol, however, did so on the assumption that price, wage, and other controls would continue, Lyons said, under which circumstances independent producers might be placed in an inequitable position if tubular-goods controls alone were removed.

Several problems . . . Lyons pointed out that there are several aspects of the oil - country tubular - goods - supply situation which continue to present problems. The 1953 supply, he said, will be inadequate to fulfill a program of 55,000 wells. The December 8 meeting developed there is a substantial unused capacity for the manufacture of tubular goods, and, while conversion pipe constitutes a very large portion of the increased availability of supplies, it is at prices which have added very materially to the cost of operation.

"In view of the fact that crude-oil prices have been frozen, while all costs of operation have been permitted to increase substantially, the difficulties faced by the industry in carrying out the PAD program have been increasing," he declared.

Accordingly, Lyons said, PAD should seek decontrol of tubular goods as soon as practical and in the meantime should "take action to alleviate the burdensome conditions which are threatening the necessary funds and incentives for the essential expansion of petroleum production capacity."

Tanker Study Imminent

WASHINGTON.—A grand jury investigation into the circumstances surrounding the purchase of surplus tankers from the old Maritime Commission and its successor, the Maritime Administration, was put under way by the Department of Justice last week.

Atty. Gen. James P. McGranery said it would be concerned with the purchase of surplus vessels by the North American Shipping & Trading Co., United Tanker Corp., American Overseas Tanker Corp., and United States Petroleum Carriers, Inc., and related companies

The department is pressing so many investigations that it is likely the tanker situation will not be explored for several weeks. A half-dozen grand juries have been empaneled but have so many matters before them that it may be late in January before evidence can be submitted on the tanker deals, according to a department spokesman.

"Shortage" Order Revoked

WASHINGTON. — The Petroleum Administration for Defense revoked instruction No. 2 last week, terminating the authority to establish local industry advisory councils to help overcome any products shortages.

The order was issued at the time of the refinery strikes last May, when PAD set up an organization to deal with any shortages which might develop. The other parts of the order were revoked last July 9, and its final erasure was ordered when it became evident there would be no likely need for the use of committees.

Record Oil-Tax Revenue Seen

WASHINGTON.—Treasury revenue from the four federal oil taxes will top the billion-dollar mark this year, it is indicated by the experience in the first 10 months. The increased rate on gasoline and the new tax on diesel fuel will increase receipts by some $300,000,000 over 1951, it is forecast.

Collections for the first 10 months of the year aggregated $817,661,496, compared with $591,392,271 for the corresponding period in 1951, according to Internal Revenue Bureau figures.

Gasoline, the largest revenue producer in the group, returned $699,-751,248 during the period against $496,606,626 last year, while lubricating oils produced $79,523,502 against $73,327,293, pipe-line transportation $26,220,238 against $21,457,-363, and diesel oil, on which the tax became fully effective last December, $12,166,508.

The bureau's monthly report shows that in October it collected $80,899,-137 from gasoline against $60,033,376 last year; $6,474,679 from lubricating oils against $7,866,570; $2,112,292 from pipe-line transportation against $2,677,815; and $1,509,647 from diesel fuel.

Chance to Reply

"Cartel" firms may get to tell Congress their views

WASHINGTON. — Officials of oil companies named in the Federal Trade Commission's cartel investigation may get an opportunity to tell a congressional committee what they think of the FTC.

Hearings on the activities and policies of governmental regulatory bodies planned by Rep. Charles A. Wolverton of New Jersey, who will be chairman of the House Interstate Commerce Committee next year, may be expanded to permit industry to present its views on how the agencies are operating.

The trade commission, as well as the Federal Power Commission and Interstate Commerce Commission, will be investigated by the committee to determine that they are acting in conformity with the laws they administer.

If any of the industries have complaints of unjust treatment or suggestions for improvement in either the laws or policies they should be given an opportunity to submit their views, Wolverton said.

Wolverton refused to comment on the cartel study but said the oil industry and its problems are so vital to national welfare they should be carefully studied.

Wolverton indicated a belief that any question affecting oil is a subject for consideration by his committee. His statement indicated possibilities that the committee will go into such diverse fields as the handling of price regulation, the Paley commission report, and national fuel policy.

Spraberry Spacing Set

Texas regulatory body approves 80-acre pattern with an 80-acre tolerance; upswing in drilling activity expected

AUSTIN. — Wider spacing for the Spraberry trend has been approved by the Texas Railroad Commission. The commission last week announced it would issue a spacing order "within a few days."

The commission set the pattern for future development in the vast area by fixing 80-acre proration units with an 80-acre tolerance, which gives an operator an option of drilling either on an 80-acre or a 160-acre spacing pattern.

The ruling was on the application of 53 Spraberry operators and followed a lengthy hearing conducted in September and arguments on the briefs December 9.

In deciding on the 80-acre spacing, the commission also approved the operators' "Plan A," which allocates production on the basis of 75 per cent for acreage and 25 per cent per well. Under this method, wells drilling on 40-acre units at the time the 80-acre pattern is adopted will have allowables equal to those of wells drilled on the new basis.

Approval of the 80-acre spacing plan means that no operator in the future may drill on a 40-acre unit without a special hearing before the commission and the granting of an exception to the field rules.

The action of the Railroad Commission is expected by many operators to result in an immediate upswing in drilling activity in the Spraberry trend.

While at the first of 1952 about 200 rigs were running in the trend, the figure had dropped to 41 at the beginning of December, and there was evidence that many operators were holding up their drilling programs pending a decision on their application for wider spacing.

Basic consideration in the spacing question was the fact that wells in many Spraberry areas will not pay out on a 40-acre basis. Much of the testimony at the September hearing was presented to show that a well would drain 80 or 160 acres and therefore would be profitable venture. Forty-acre spacing, the operators contended, would mean that drilling on much of the trend would be unprofitable, that the operators would not develop these areas, and that, therefore, waste would result.

The Spraberry producing area covers approximately 500,000 acres. At present it has more than 2,200 producing wells. Some of the recent slowdown in trend activity has been attributed to lack of casing, but most of the blame has been placed on the uneconomic prospects under 40-acre spacing. *(For latest figures on trend activity, see The Oil and Gas Journal, December 8, page 81.)*

Salt Creek Flood Approved

AUSTIN.—A pilot water-flood in the Canyon Reef Salt Creek field of Kent County has been approved by the Texas Railroad Commission.

General Crude Oil Co. had asked approval of the proposed flood. The hearing was held August 27.

On granting approval, the commission required injection wells to be at least half a mile from nonunitized wells unless operators of nonunitized wells agree. It also provided that allowables of injection wells might be transferred to any other wells producing from the same reservoir.

T.P.R.C. OFFICIALS.—Texas Petroleum Research Committee officials who conducted T.P.R.C.'s Fifth Oil Recovery Conference at A. & M. College of Texas, College Station, December 11-12. Left to right are Texas A. & M. Prof. Robert L. Whiting, acting director, T.P.R.C.; Texas A. & M. Prof. Harold Vance (now vice president, oil department, Second National Bank of Houston); Texas A. & M. Prof. Albert B. Stevens; Dr. Paul B. Crawford, assistant director, T.P.R.C.; and Dr. E. W. Hough of the University of Texas. Not shown but present at the A. & M. meeting is the other T.P.R.C. official, Prof. H. H. Power, of the University of Texas

Research Report

Study of Texas reserves to be published next year

COLLEGE STATION, Tex. — Texas Petroleum Research Committee's detailed oil-reserve report is now over 95 per cent complete and will be available to the petroleum industry early in 1953, Acting Director Robert L. Whiting announced at T.P.R.C.'s Fifth Oil Recovery Conference held here December 11-12.

The study, which entails a secondary-oil-reserve survey for every oil field and every separate reservoir in the state of Texas, has been a major effort during the past 2½ years by Texas Petroleum Research Committee.

Professor Whiting, also a faculty member of A. & M. College of Texas, detailed current activities of T.P.R.C. and its organizational background. The committee was established by joint resolution of the officials of A. & M. College of Texas, Railroad Commission of Texas, and University of Texas. At this time, research expenditures are at the rate of $100,000 per year, divided equally between Texas A. & M. and University of Texas.

Dr. Paul B. Crawford, assistant director, is in charge of research at the committee's A. & M. division. Present research projects cover correlation of K-values on hydrocarbon systems, application of nuclear magnetic resonance for studying reservoir core and fluid properties, fractured and heterogeneous reservoirs, determining maximum efficient rates of production, determining when to initiate pressure maintenance programs and what fluids to inject, and economic studies of various new production methods.

Research at University of Texas includes design of pressure-volume-temperature equipment, frictional losses in tubing under two-phase fluid flow, determination of reservoir pressure in natural gas reservoirs.

CANADA

New Refinery Planned

KAMLOOPS, B. C.—Kamloops Refinery Syndicate has announced plans for building a $3,000,000 refinery here in south central British Columbia.

The 2,500-bbl. per day plant will operate on Alberta crude, to be purchased from Trans Mountain Oil Pipe Line Co. Initial operation is scheduled for early 1954. According to Sidney Smith, chairman of the syndicate, $500,000 has been subscribed for the project by interests in British Columbia and eastern Canada.

Sun to Build Products Line

SARNIA, Ont.—Sun Pipe Line Co. of Canada plans to construct a 200-mile, 8-in. products pipe line to serve the London-Hamilton-Toronto markets out of its new 15,000-bbl. per day refinery now building near here.

Completion of the line is scheduled to coincide with initial operation of the refinery during the third quarter of 1953. The line will handle gasoline and No. 1 and 2 heating oils.

The company is a wholly owned subsidiary of Sun Oil Co., Ltd.

Contract Let for Crude Lines

VANCOUVER, B. C.—Contract for three lines to deliver crude from the Trans Mountain system has been awarded Missouri Valley Canadian, Ltd., Winnipeg.

The three lines will run from the Burnaby tank farm, Trans Mountain's western terminus. They will include a 2½-mile line to the Shell refinery at Shellburn, a 6-mile line to the Ioco refinery of Imperial Oil, Ltd., and a 3-mile line to the Trans Mountain loading dock at Barnet, on Burrard Inlet.

Total cost of the three lines will be approximately $1,000,000. Canadian Bechtel, Ltd., agent for Trans Mountain Pipe Line Co., said right-of-way clearing is expected to begin within 30 days. Pipe will be laid next spring.

Line Plans Announced

EDMONTON, Alta.—Trans Mountain Pipe Line Co. intends to construct a large-diameter feeder line from Sumas, B. C., to Ferndale, Wash., in order to give maximum distribution of Alberta crude oil at the West Coast from the company's 711-mile line over the Rockies from Edmonton to Vancouver, B. C.

This was announced here by Robert L. Bridges, of San Francisco, president of Trans Mountain, during a company directors' meeting in Edmonton. The oil-line extension will be in addition to a marine loading terminal at Barnet, on Burrard Inlet, and a western tank farm at Burnaby, a Vancouver suburb.

The feeder line from Sumas to Ferndale will serve the new refinery of General Petroleum Corp. It will be made up of 18 miles of 24-in. steel pipe and 12 miles of 16-in. pipe. Trans Mountain has decided these line diameters will "make the most efficient use of the very high hydraulic pressure resulting from the drop from the Coquihalla Pass to the coastal plains."

Alberta crude can be carried by gravity to Ferndale or to other refinery locations in Washington, as far south as Seattle, without construction of an additional pumping station, Bridges stated. He added that a branch line of smaller diameter would require a large additional capital cost for construction of a pumping station and attendant storage facilities.

Reserves Increase Reported

CALGARY.—Canada Southern Oils, Ltd., last week announced it increased its oil reserves by 500 per cent—to a total of 75,000,000 bbl.—during the first three quarters of 1952.

Gas reserves were estimated by company engineers at 200 billion cubic feet. Both estimates are as of October 1.

The company said it estimated discovery costs at less than 5 cents a barrel. The company's reserves are located principally in the Buffalo Coulee-Coleville area of western Saskatchewan.

Ellesmore Assets Acquired

CALGARY.—New Concord Development Corp., Ltd., last week announced it has acquired all assets of Ellesmore Oil & Development, Ltd.

The company said the deal involved recoverable crude-oil reserves of about 1,500,000 bbl. and gas reserves of about 6 billion cubic feet in North Dakota and western Canada.

Tanker Building Halted

CALGARY. — Canadian Oil Companies, Ltd., have halted work on a large Leduc class tanker which was being built to move Alberta crude from the Superior, Wis., terminus of the Interprovincial Pipe Line to the company's new 20,000-bbl. per day refinery near Sarnia, Ont.

The extension of the Interprovincial system to Sarnia next year will obviate the necessity of relying on tanker shipments through the Great Lakes.

The constant year-round supply of crude to Sarnia will permit Canadian Oils to boost annual refinery runs considerably higher than 5,000,000 bbl. The new pipe-line extension will also save the company $2,000,000 in crude storage, now required to continue operations during the 4-month winter period during which Great Lakes shipping is tied up.

WEST COAST

Price Hike Pending

OPS decision expected soon on West Coast adjustments

LOS ANGELES. — The Office of Price Stabilization in the next few weeks is expected to reach a decision on whether or not California crude and product prices will be adjusted upward because of the petroleum shortage existing on the West Coast.

The action was indicated by OPS officials following a conference here last Monday and Tuesday with representatives of the California industry.

The latter presented data on the existing situation and showing how a price boost would tend to encourage exploration and secondary-recovery activities. The situation will become worse, it was claimed, unless ceiling prices are revised upward.

The Petroleum Administration for Defense already has recommended to OPS that an across-the-board increase be made in California crude and product prices *(The Oil and Gas Journal, December 8, page 69)*.

OPS and PAD officials from Washington presiding at the hearing were E. E. Fogle, director of the rubber, chemical, and fuels division; G. B. Burkhalter, chief of the petroleum branch; Roland Preisman, OPS special assistant; and C. E. Davis, PAD assistant deputy administrator.

Well No. 100 Completed

LONG BEACH.—Completion of the 100th well by Richfield Oil Corp. in the 245-acre tideland tract it is developing from Pier A was observed here by officials of the company and the city of Long Beach.

Since the company started developing the lease in 1947, more than 16,800,000 bbl. of crude has been produced. Total value of the oil and gas products was $35,662,073, of which the city netted $24,397,000. Richfield, as operator, received approximately 7 per cent royalty.

Ranger, upper and lower Terminal, and Tar zone production have been established on the lease, which is producing about 12,000 bbl. daily.

Nationalization Endorsed

Oil dealt major blow by U.N. approval of Bolivia-Uruguay resolution failing to include provision for compensation

Dahl M. Duff

ONE of the top committees of the United Nations has voted approval of the right of any country to nationalize the development of its natural resources.

Making the action even worse from the standpoint of oil and other private investors was the fact that the group rejected amendments to the proposal which asserted the nationalizing country's obligation to pay compensation.

The resolution was introduced under combined Uruguayan-Bolivian sponsorship and approved by the General Assembly's Economic and Financial Committee on which all 60 member nations of the U.N. are represented.

In the final ballot on the main resolution, the single dissenting vote was cast by the United States. In the earlier, even more significant voting on the amendments, it was the smaller, so-called underdeveloped countries of the world which formed a majority and defeated attempts to soften the proposal.

The resolution plainly was a blow at private, foreign investment of which the petroleum industry is considered to have the greatest total. It was another manifestation of the strong antiforeign and nationalistic sentiment existing over the world. In effect, it served notice on private investors that nationalization with or without compensation has received at least some sanction in the U.N.

Russian victory . . . The passage of the resolution by the committee was a victory for the Russian bloc, which consistently has used the U.N. and its branches as a forum for hammering away at the theme that the smaller countries of the world are being exploited ruthlessly by the larger, more-industrialized nations.

Attempts of the United States representative, Isador Lubin, to explain the amendments he offered were voted down when the committee approved closing discussion. The resolution will come up later before the full, plenary session of the General Assembly, and the United States delegation is expected to contest the proposal in fuller debate.

"Pressure" clause . . . The resolution which was approved reads in part as follows: "The General Assembly . . . remembering that the right of peoples freely to use and exploit their natural wealth and resources is inherent in their sovereignty and is in accordance with the purposes and principles of the charter of the United Nations, recommends all member states, in their exercise of their right freely to use and exploit their natural wealth and resources wherever deemed desirable by them for their own progress and economic development, to have due regard, consistently with their sovereignty, to the need for the maintenance of mutual confidence and economic cooperation among nations; recommends further all member states to refrain from acts, direct or indirect, designed to impede the exercise of the sovereignty of any state over its natural resources."

The last clause of the resolution in effect asks that investing nations such as the United States avoid any diplomatic or other pressure on behalf of its nationals once nationalization is carried out. The changes proposed by the United States would have called attention to the obligation for compensation and deemphasized nationalization as a development policy.

The vote . . . In the most important of the several votes taken on the United States amendments, 15 nations voted affirmatively, 27 in the negative, 8 abstained, and 10 were absent.

Voting against the United States proposal were Afghanistan, Argentina, Bolivia, Brazil, Byelorussia, China, Colombia, Czechoslovakia, Ecuador, Egypt, Salvador, Ethiopia, Guatemala, India, Indonesia, Iran, Iraq, Mexico, Pakistan, Panama, Poland, Saudi Arabia, Ukraine, Russia, Uruguay, Yemen, and Yugoslavia.

Nations abstaining were Australia, Burma, Costa Rica, Haiti, Israel, Peru, Thailand, and Venezuela. Absent were Cuba, Dominican Republic, Honduras, Iceland, Lebanon, Liberia, Luxembourg, Nicaragua, Paraguay, and Syria.

Those favoring the amendments were Belgium, Britain, Canada, China, Denmark, France, Greece, Netherlands, New Zealand, Norway, Philippines, Sweden, Turkey, South Africa, and the United States.

There's No Supply House, So.....

. . . In some foreign operations, the oil companies operate their own. Shown here is a pipe yard of one of the companies in the Lake Maracaibo area of western Venezuela. With little equipment readily available from other sources, the companies order their supplies months ahead and keep adequate stocks on hand in supply areas such as this. (Hamilton Wright photo).

Aden Case Argued

Adverse decision would wreck British policy of claiming all oil sold by Iran prior to agreement on compensation

THE fate of the first and thus far only cargo of oil exported from Iran since the British-owned industry was nationalized was being argued last week before the Supreme Court of the British Protectorate of Aden at the southwestern corner of the Arabian Peninsula.

The oil involved in the legal contest is that lifted last June by the 632-ton tanker, Rose Mary. Anglo-Iranian Oil Co., Ltd., brought injunction proceedings when the vessel put in at Aden. The cargo amounts to about 5,900 bbl. which, f.o.b., Persian Gulf, is worth about $10,300.

Outcome vital . . . Importance of the action lies in the fact that a defeat in this first case and one before a British court, would wreck the announced British policy of asserting legal claim to any Iranian oil sold in world commerce before an agreement is reached on compensation. Anglo-Iranian sent one of Britain's outstanding attorneys, Sir Hartley Shawcross, to Aden to argue the case.

Opposing him were Italian and Indian attorneys representing the Rose Mary's captain; Cia. de Navegacion Teresita, the owner of the ship; and the Swiss Bubenberg Co., which chartered the Rose Mary for the Iranian voyage.

Shawcross contended before the court that Anglo-Iranian's published worldwide warnings of possible legal action fully notified prospective purchasers of the situation and that, in nationalizing the properties, Iran had violated clauses of the concession contract guaranteeing it would run until its normal termination. He denied that Royal Air Force planes had forced the Rose Mary into Aden and said that the ship merely had been spotted by the RAF which had been asked to report the ship's position.

Acheson criticized . . . Meanwhile, in Teheran, Hussein Makki, secretary-general of the Prime Minister Mossadegh's National Front, went before the Iranian parliament and accused U. S. Secretary of State Acheson of blocking Iran's plans to solve its difficulties growing out of the oil dispute. He charged Acheson had prevented American customers from buying Iranian oil and had nullified the sympathy which existed in the United States for Iran's position. He said Acheson was under the influence of big American companies, five of which, he said, are in an international oil cartel.

He declared Iran must achieve a healthy economy without oil income. All Iran wants from the United States, either Democrats or Republicans, he said, is that it should not endorse British policy. Makki also declared he suspected the U. S. State Department of assisting Ahmed Ghavam who replaced Dr. Mossadegh as prime minister for 3 days last July.

Settlement concern . . . The concern existing in the United States oil industry over a possible Iranian settlement which would jeopardize other foreign oil investments was voiced last week by David A. Shepard, a director of Standard Oil Co. (N. J.), in a speech in Chicago.

Shepard said Jersey Standard is much more disturbed about the possibilities of "departing from sound principles" in settling the dispute than it is by the prospect that a sudden resumption of operations in Iran would glut the world oil market. He said Iranian oil would return to world markets only slowly after any settlement and that it would be absorbed by growing demand. "After a 500,000-bbl.-daily refinery lies idle 1½ years, you don't start it up overnight," he said. "It would take a good many weeks."

The Jersey Standard official expressed the belief a settlement was a question of when and not if. His view on this point coincides with that of many other informed United States oil executives who feel that Iranian oil with its tremendous reserves cannot remain shut in indefinitely.

Iran Sure of Victory

Ambassador to U. S. renews invitation to buy Iranian oil with claim that no court will uphold A.I.O.C. position

Bertram F. Linz

AMERICAN firms buying Iranian oil need have no fear that courts anywhere in the Free World will support any suit brought by the Anglo-Iranian Oil Co., it is confidently felt by Iran's ambassador to Washington, Allah-Yar Saleh.

The basis for the ambassador's belief, he said at a press conference called to discuss the State Department's latest move, is the successful defense Iran made of its oil-nationalization before the International Court of Justice, where even the British member voted for Iran.

The ambassador declared the State Department's formal announcement that it had no objection to the purchase of Iranian oil by Americans *(The Oil and Gas Journal, December 15, page 86)* means that "no one may hereafter allege that America discourages shipments of oil from Iran."

"The ambassador of Iran desires to draw a line between a law suit and the verdict of a competent tribunal, as any person can submit a law suit at any time and for any reason, but the final verdict of the court is what really counts," he told newsmen.

Precedent cited . . . He asserted that a precedent for Iran's actions is found in the Mexican appropriation of foreign oil properties in 1938. In that case, he said, one of the companies, El Aguila, instituted proceedings in the courts of Holland, Belgium, and France with a view to seizing the oil sold by Mexico on the ground it remained the property of the company, but the three European courts ruled in favor of Mexico.

The courts held that a decision in favor of the company would be tantamount to reviewing in a foreign court the acts of public law of the Mexican Government, a sovereign state, Saleh explained.

"Risks" discounted . . . "I, therefore, believe that potential purchasers of Iranian oil should not place more importance on the word 'risks' mentioned in the State Department's press release than what was actually intended," he said. "The former Anglo-Iranian Oil Co. may attempt to bring legal action, but there is not the least doubt that any respectable court will decide in favor of Iran."

Saleh said the Consolidated Brokerage Co. is the only interest he knew to have made a deal for Iranian oil, although, he added, others have made inquiries and may have received contracts.

The ambassador said he knew nothing of reported proposals by the State

Department that American companies and A.I.O.C. set up a corporation to move Iranian oil provided the Iranian Government gave a pledge of compensation. No thought has been given to the sale of the company's properties to an American purchaser, he said in commenting upon another rumor.

Extending an open invitation to American importers to buy oil, Saleh said his government is still willing to sell to the A.I.O.C. "or any other shipper."

He admitted that Iran's financial situation is becoming steadily worse, but he said there is no chance of Britain being able to force Premier Mossadegh out of office and the "pressure only increases popular support" for the virtual ruler of the country.

Discovery claimed . . . Possible new oil reserves have been found about 100 miles south of Teheran by Iran Petroleum Co., a government company formed before nationalization which handles oil development other than the A.I.O.C. properties. Saleh said four wells have been drilled so far, however, no estimate has yet been possible of the extent of the new discoveries.

Earlier this month, State Department officials discussed the Iranian situation with oil-company officials, and Paul Nitze, chief of the department's planning division, stopped off in London for discussions with British officials before going on to Paris.

Saleh said the department had not informed him of Nitze's trip and that he knew nothing of rumors that the discussions would involve proposals for a temporary lifting of the A.I.O.C. ban, but declared the ban is "wicked" and should be removed permanently.

Bahrein Adopts 50-50 Tax

The pattern of 50-50 profit-sharing agreements has become universal in the Middle East with the extension of this principle of government participation to oil production in Bahrein.

Bahrein Petroleum Co., Ltd., a member of the Caltex group, announced last week that it is formally notifying authorities of the Persian Gulf Shaikhdom of its acceptance of a new 50-50 income tax.

The tax was embodied in a decree law which is effective retroactively to January 1, 1952. It applies only to net income from the production and sale of Bahrein crude. Production from the single field in Bahrein has been stabilized at about 30,000 bbl. daily.

Caltex gave no estimate of its payments under the tax, but other agreements of this type in the Middle East are understood to give the rulers concerned a per-barrel revenue varying in the different countries from about 50 to about 70 cents. Bahrein Petroleum also operates a refinery in Bahrein Island which has a capacity of around 200,000 bbl. daily, but its operations are presumably not affected by the new tax.

New Plan for Iran

U. S. suggests big loan and claims adjudication

STATE Department officials are working out with the British a new Iranian oil-settlement plan which would involve the assistance of American companies in marketing production from the nationalized properties.

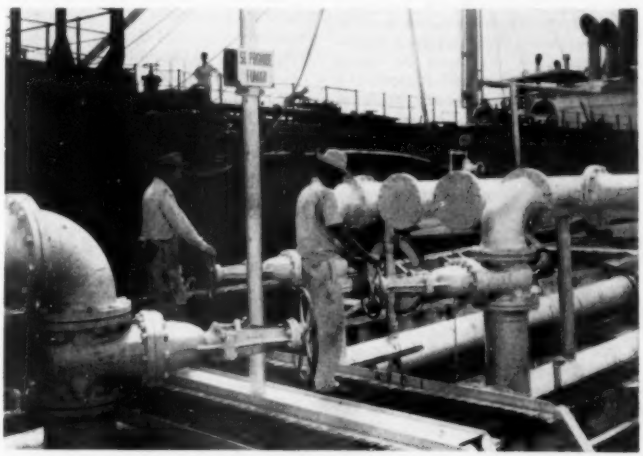
Secretary of State Acheson and other high department officials were meeting with British Foreign Secretary Eden and other British representatives in Paris. The direction the discussions were taking was indicated in reports from London, Washington, and Paris.

Economy prop . . . A key part of the plan would involve a loan of perhaps $100,000,000 to Iran from the United States or some agency such as the International Bank for Reconstruction and Development. The British claim to compensation for the properties would be submitted to the World Court or some special tribunal for adjudication.

The outgoing administration in Washington is said to be anxious to wind up the Iranian dispute before it leaves office next month. Essentially, the plan under discussion would allow Iran to run the oil industry without British assistance but with some kind of assured market and give Prime Minister Mossadegh an opportunity to shore up the Iranian economy and possibly pay the compensation claims at least indirectly with American funds.

Dulles' reaction . . . In New York, John Foster Dulles, who will be Secretary of State under the Republican administration, denied he had been consulted about the proposed settlement plan. British officials have been described as cool to the proposal but are understood to be under pressure from the State Department, which is acting under instructions from President Truman. Behind the United States action is the fear of a Communist coup in Iran, for which the outgoing Democratic administration in Washington might be blamed politically.

President-elect Eisenhower reportedly is equally anxious for a quick settlement, and it was reported the lines followed by Acheson have been approved by John Foster Dulles, who will succeed him as Secretary of State next month.



Still Working, but Without Much Future

Lake Maracaibo's shallow-draft tankers, such as the one shown here being loaded, are gradually being made obsolete. They have been in use since the early days of Maracaibo oil production to carry the crude across the sand bars at the mouth of the lake and onto deep-water terminals for transshipment or refining. In the last 4 years, Shell and Creole each have built large-diameter pipe lines directly out of the lake region, and Creole is now preparing to lay still another parallel line. In addition, the Venezuelan Government is commencing dredging of a deep-water channel which will permit tankers drawing as much as 34 ft. to enter the lake. This $36,000,000 project, of which about $24,000,000 was loaned by several oil companies, will take about 4 years to complete. (Hamilton Wright photo).

PERSONALS

Exploration Head

W. Dow Hamm plays active role in petroleum geology

W DOW HAMM, general manager of both foreign and domestic exploration for Atlantic Refining Co., has been active in petroleum geology for more than 30 years.

Hamm, a graduate of the University of Oklahoma, began his career in 1921 as a field geologist for Arkansas Natural Gas Co. A year later he joined Shell Oil Co. He served Shell and affiliated companies for 20 years in various exploratory positions in the United States and Europe.

When he resigned from Shell in 1942 he was assistant manager of exploration at Houston. From September, 1942 until last April he served as manager of exploration in North America for Atlantic.

He has served as an American Association of Petroleum Geologists representative and vice president of the Dallas Geological Society. Other organizations of which he is a member include the American Petroleum Institute, Mid-Continent Oil and Gas Association and Dallas Petroleum Club.

He also is a trustee of the University of Oklahoma Foundation and is active in community work.

Milton D. Dobrin, Magnolia Petroleum Co., has been elected president of the Dallas Geophysical Society for the coming year. **Dr. C. G. Dahm,** Magnolia, formerly secretary-treasurer, was elected first vice president. **R. H. Andrews,** Andrews Geophysical Service Co., was named second vice president, and **W. J. Harkey,** National Geophysical Co., was named secretary-treasurer. New officers take over in January.

W. B. Airth, general manager of Ajax Petroleums, Ltd., Toronto, Ont., has been elected president of the company. He will continue his duties as general manager as well as those of president and general manager of Ajax Alberta Pipeline, Ltd., a wholly owned subsidiary of the oil company. He replaces **J. B. Adoue,** who resigned but who will remain a director.

H. G. Chase, Pure Oil Co., Chicago, has been elected chairman of the state and local taxation committee of the Mid-Continent Oil and Gas Association. **Frank Lawshe** of Al Buchanan Drilling Co., San Antonio, was named vice chairman.

D. N. Myers, president of Byerlyte Corp., Cleveland, has been elected chairman of the executive committee of the Asphalt Institute. **Bernard E. Gray** was reelected president at the annual meeting of the board of directors in New York recently. Vice presidents elected for the five geographical divisions were: **Charles Else,** The Southland Co.; **P. C. Doyle,** Standard Oil Co. (Ohio); **Henry G. Groves,** Farmers Union Central Exchange, Inc., **D. D. Williamson,** American Liberty Oil Co.; **Howard D. Webb,** Envoy Petroleum Co.

Frederick B. Lewis, an engineer in the operations-analysis department of the Esso Standard Oil Co. refinery at Everett, Mass., has been named head of the refinery service department. **Bruce W. Young,** formerly technical assistant to both the plant manager and general superintendent, has been transferred to the oil movement and storage division where he will be trained to succeed **S. S. Reynolds,** division head who will retire soon. **Edward A. Bannon,** oil movement and storage foreman, is training to succeed **David F. Fitzgerald,** assistant head of the department who is scheduled to retire February 1.

S. C. Eastwood has been named assistant supervisor of the process-development section of Socony-Vacuum Oil Co.'s research and development department at Paulsboro, N. J. In the same section, **A. E. Potas** and **C. C. Stapleford** have been appointed research associates. **G. J. Visconty** has been made a research associate in the engineering and economics section.

R. R. Dean has joined Tennessee Production Co. as a vice president as a result of the purchase of Del Rey Petroleum Co., of which he was part owner, by Tennessee Gas Transmission Co. and its subsidiary, Tennessee Production Co.

J. N. Troxell has been promoted to general manager of the producing department of The Texas Co., effective January 1. He succeeds **E. R. Filley,** who has been named vice president of domestic production operations. Troxell has been assistant general manager of the producing department since January 1950.

C. T. (Chuck) Jones, manager of the exploration department of Stanolind Oil & Gas Co. the past 3 years, has resigned to go into business for himself. He will be a party in a joint venture with McAlester Fuel Co. and will continue to make his home in Tulsa.

D. DOLSON

David Dolson, Grand Rapids, Mich., has been appointed vice president of Mid-West Refineries, Inc., in charge of crude oil supply. He will handle pipe-line transportation for all the crude oils purchased by Mid-West for its refinery at Alma, Mich. Dolson has been with Mid-West the past 2 years.

H. T. Oleson, manager of joint operations for Superior Oil Co. at Midland, Tex., has resigned to become a petroleum consultant and independent oil operator at Dallas. He had been with Superior more than 15 years.

Stanley C. Hope, president of Esso Standard Oil Co., has been made an honorary deputy commissioner of commerce of New York City.

R. F. Pielsticker, president of Stanolind Oil Purchasing Co., Tulsa, has been named to serve temporarily as general manager of crude-oil supply and products lines for Standard Oil Co. (Ind.). He will go to Chicago to replace **R. E. Nelson, Jr.,** who has been named director of the supply and transportation division of the Petroleum Administration for Defense in Washington, D. C. During Pielsticker's absence **D. L. Wolfe,** executive vice president, will be in charge.

PERSONALS

Travis L. Hartzo, tool pusher for Penrod Drilling Co., has been transferred from Jena to Morgan City, La.

Walter I. Clark, veteran pipe-line engineer in Texas for Sinclair Pipe Line Co., has retired. He first was employed by Prairie Pipe Line Co. in Independence, Kans., and came to Texas in 1918 as division engineer at Ranger. He was with Prairie at Eastland at the time of the company's merger with the Sinclair interests in 1932.

Harvey H. Ward, Jr., Edmonton, Alta., has been appointed drilling superintendent for Arrow Drilling Co. of Canada, Ltd. He has been with Arrow a number of years in both the United States and Canada as an engineer, driller and tool pusher.

Neal Clayton has been appointed assistant manager of the domestic field division of Century Geophysical Corp. of Tulsa. **P. I. Bediz,** who for the past 3 years has served as chief geophysicist for Century in Canada, has been promoted to chief geophysicist for both domestic and Canadian operations.

Paul W. Netterstrom has resigned as a geologist for Far West Oil Co. at Casper to become a consultant there. He has been active in the Rocky Mountain area since 1941.

E. B. Swanson, who is in charge of petroleum statistics for the Department of the Interior, has been awarded a plaque by the American Petroleum Institute statistical advisory committee in recognition of his service to the petroleum industry.

Chester L. May, vice president of Lone Star Gas Co., Dallas, was one of four Southwest businessmen elected state directors and members of the board of the National Association of Manufacturers. May is a past president of the Texas Manufacturers Association and the Southern Gas Association.

E. A. Thoes, Jr., mechanical engineer for Shell Oil Co., has been transferred from Midland, Tex., to Tulsa. Other company changes involve: **K. E. Fink,** area mechanical engineer, transferred from Tulsa to New Orleans; **H. S. Mayberry,** field geologist, transferred from Wichita to the Illinois division; **R. D. Cramer,** transferred from Tulsa to the Illinois division as junior geologist; **J. S. Dodd, Jr.,** geologist, transferred from the technical services department at Wheatridge, Colo., to Denver; **A. D. Barnes, Jr.,** transferred from the technical services department to Elk City, Okla., as district exploitation engineer; and **H. D. Cox, Jr.,** mechanical engineer, transferred from New Orleans to Tulsa.

Permian Basin Geophysical Officers Named

New officers of the Permian Basin Geophysical Society, elected at the annual meeting of the group December 6 in Midland, are shown above. They are, left to right, E. L. Campbell, treasurer; G. A. Grimm (seated), president; L. Decker Dawson, first vice president; and Joseph S. Pluta, secretary. William A. Reeves, second vice president, is not in the picture.

L. A. Toone, manager for the Shell organization in Colombia, is leaving the post in January for a new assignment with the company in Europe. **E. A. Higgins** will be the new Shell manager in Colombia with **J. M. Vengoechea** and **C. B. Roach,** as assistant managers, and **George M. Thomson,** assistant to the management. Toone joined Shell in 1925 and was manager of Anglo-Egyptian Oilfields, Ltd., in Egypt before going to Colombia in 1946.

George S. Wilson, district petroleum engineer in Magnolia Petroleum Co.'s Alice (Tex.) producing district, has been transferred to Vanderbilt, Tex., as assistant district production superintendent.

Emmett A. Vaughey, Jackson, Miss., independent operator, has been named head of the production division of the Petroleum Administration for Defense. He will succeed **Robert L. Foree,** Dallas, on December 24. Foree has returned to private business.

Paul Bearden, engineer for Texas Gas Corp. at Winnie, Tex., has been appointed assistant to **John T. Ashford,** vice president in charge of production and gas engineering. Bearden will be located in the Houston office.

Myrven L. Mead has been promoted from assistant to the president to vice president of Northern Natural Gas Co., Omaha. Mead has been with Northern since 1931 and was promoted from rate engineer to assistant to the president in 1950. He received his engineering degree from the University of Nebraska.

Nicholas R. Dupont and **James R. Grandin,** both of Wilmington, Del., have been elected to the board of directors of New World Oil, Ltd., Edmonton, Alta.

J. K. Alfred has been appointed to the newly created position of assistant to **D. H. Lewis,** vice president of Shell Pipe Line Corp., Houston, on engineering and project development matters. Alfred formerly was administrative operations engineer at Houston. **J. B.**

PERSONALS

Thompson, who recently returned from an assignment in Venezuela, has been named temporary assistant to **D. F. Sears,** vice president.

T. M. Ocheltree, northern division petroleum engineer for Warren Petroleum Corp. at Tulsa, has been appointed chief petroleum engineer at Houston.

Joseph August, Jr., administrative assistant to manager of the Lima refinery of Standard Oil Co. (Ohio), has been transferred to the home office in Cleveland as assistant to **F. J. Sanders,** technical manager of the manufacturing department. He joined Sohio in Cleveland in 1938 following graduation from the University of Michigan as a chemical engineer.

Robert L. Minckler, president of General Petroleum Corp., has been named to the board of directors of the California State Chamber of Commerce.

John W. Moyer has been elected president and managing director of Home Oil Co. of Vancouver, B. C. He succeeds **Robert B. Curran,** who has resigned.

L. W. Randerson, petroleum engineer for Magnolia Petroleum Co. at Midland, Tex., has been promoted to senior petroleum engineer. Other company changes involve: **B. A. Barnes,** senior petroleum engineer at Dallas, promoted to section chief in charge of fluid injection and hydrology; **Charles F. Girand** and **Gerald L. Smith,** petroleum engineers at Dallas, promoted to senior petroleum engineers; **Gilbert M. Andreen,** petroleum engineer at Dallas, promoted to district petroleum engineer at Alice, Tex.; **John D. Howard,** petroleum engineer at Vanderbilt, promoted to district petroleum engineer, succeeding **W. A. Daniel,** who has been transferred to Kermit, Tex., as district petroleum engineer; **J. W. W. Whitney, Jr.,** petroleum engineer in the Shreveport producing district, has been promoted to district petroleum engineer in the Wewoka, Okla., district; and **A. J. Monzingo,** district petroleum engineer at Wewoka, transferred to the Salem, Ill., producing district as district petroleum engineer.

Gordon Russell, corrosion engineer for Union Gas Co. of Canada Ltd., Chatham, Ont., has been named distribution engineer. He will serve as technical assistant to **L. F. Near,** superintendent of transmission and distribution.

Ardris Haig, district geologist for Phillips Petroleum Co. at Denver, has been named district geologist for the combined Salt Lake City and Denver land and geological offices. Headquarters of the new district will be in Denver. **Orlo E. Childs,** formerly district geologist at Salt Lake City, has been appointed director of a new exploration projects group in the exploration section of the land and geological department at Denver.

Raymond M. Goldston, formerly superintendent for Uinta Refining Co. at Jensen, Utah, has been appointed general manager for Wesco Refining Co. at Rangely, Colo.

DEATHS

Avery Brewster George, 46, a chemical engineer for Standard Oil Development Co. at Linden, N. J., died December 7 at his home in Cranford, N. J.

Richard D. Montgomery, 62, vice president of Richfield Oil Corp., died in Los Angeles December 10. He was elected vice president in April 1951, after serving as manager of the exploitation department since 1937. He had been with Richfield since 1926.

Harry Willard Bruce, 81, superintendent of the old Pierce-Fordyce Oil Co. until his retirement 10 years ago, died December 10 in Tulsa.

J. F. Jeffries, 66, who formerly held executive positions with Standard Oil Co. of California, died at his home in Pomona, Calif., December 11. He served as assistant district manager at San Diego, district manager at Stockton, Calif., and Los Angeles, and assistant general sales manager at San Francisco.

John Benton Brewer, 57, former oil editor of the San Angelo, Tex., Standard-Times, died at his home in San Angelo December 12. He retired September 1 because of ill health.

L. T. Fowler, 75, retired Midland, Tex., oil broker, died December 9.

Oliver Shinn Alloway, 80, a retired lease man for the old Prairie Oil & Gas Co., died in an automobile accident near Oklahoma City December 11.

Harry A. Hanson, 59, Washington, Ind., president of the H. & G. Oil Co., died December 7.

William Copp, 74, independent oil operator, died December 18 in Tulsa.

Walter Wells, 49, drilling superintendent for Sinclair Petroleum Co. in Ethiopia, died recently of a heart attack at Ogaden, Ethiopia. He was in charge of drilling for Venezuela Petroleum Co., a Sinclair subsidiary, at the time of the first oil discovery of the company in that country in 1941. He later was in charge of drilling for Sinclair and associated companies in Colombia.

J. V. Collins, Denver, consulting petroleum engineer, died recently following a heart attack. He formerly was division petroleum engineer for The California Co.

Frederick Fair, 81, a director of Wolf's Head Oil Refining Co., died December 11 in Oil City, Pa. He was president of Venango Oil & Land Co. and vice president of Cairo Oil Co. and O'Day Oil Co.

Thomas J. Murphy, 64, field superintendent for the H. C. Bennett Oil Co., died in Halstead, Kans., December 13.

Kendall B. Rowell, 52, chief engineer of American Locomotive Co., died in Schnectady, N. Y., December 12. He was appointed Alco chief engineer only last November 5.

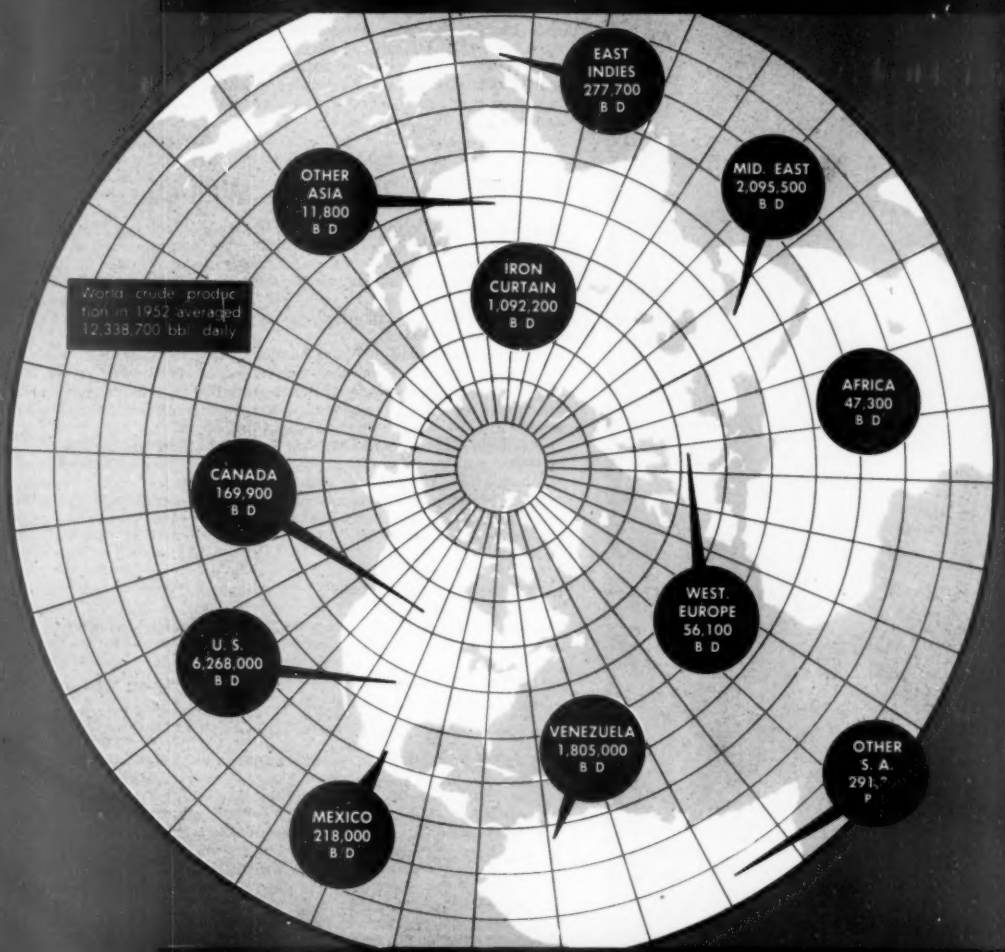
George W. Fox, secretary and assistant treasurer of the Texas Pipe Line Co., died December 13 in Houston.

Deloss Knapp, 68, retired statistician for Sinclair Refining Co., died December 16 in New York.

Charles F. Terrell, Jr., 44, division production engineer for Sinclair Oil & Gas Co. at Independence, Kans., died recently.

International Oil

. . . an analysis of operating data, methods, and technology around the world


EAST INDIES 277,700 B D
OTHER ASIA 11,800 B D
MID. EAST 2,095,500 B D
IRON CURTAIN 1,092,200 B D
World crude production in 1952 averaged 12,338,700 bbl. daily
AFRICA 47,300 B D
CANADA 169,900 B D
WEST. EUROPE 56,100 B D
U. S. 6,268,000 B D
VENEZUELA 1,805,000 B D
OTHER S. A. 291,?
MEXICO 218,000 B D

. . . A SPECIAL SECTION

Presented By The Oil and Gas Journal

PETROLEUM: A

Petroleum has truly become a world industry—and yet it has just started in the full realization of its global potentialities.

Supplies which for more than a half century largely centered in one country, have spread until nearly half of the output comes from scattered areas outside the United States. Seventy per cent of the world's proven reserves are now located in the newer areas.

Tanker lanes and pipe lines connect remote supplies to shipping and consuming centers. Refining has become a major industrial enterprise in many countries. War rehabilitation and the postwar objectives of better living for all peoples have been and will continue to be based on petroleum.

The accomplishments of the past in many areas have been brought about through the cooperation of private companies supplying the mammoth capital requirements and the know-how, and governments controlling the minerals. So long as these contractual arrangements are mutually respected and adhered to, the continued growth of the world oil business is assured.

English

EL PETROLEO—INDUSTRIA MUNDIAL

De hecho convertida en industria mundial, la del petróleo apenas empieza a percatarse de la potencialidad que tal carácter engendra.

Principalmente concentradas en un solo país durante más de medio siglo, las fuentes de abasto se han ido extendiendo. Hoy día, cerca de la mitad del consumo mundial proviene de regiones dispersas por fuera de los Estados Unidos. Y esas nuevas regiones contienen el setenta por ciento de las reservas probadas.

Flotas de tanqueros y redes de oleoductos conectan yacimientos remotos con los centros de embarque y de consumo. En muchos países, la refinación es una destacada actividad industrial. En la posguerra, el petróleo ha servido y sirve de base a la rehabilitación y al esfuerzo por mejorar las condiciones de vida de todos los pueblos.

En muchas partes, ese progreso se ha realizado mediante acción conjunta por parte de compañías privadas que aportan los ingentes capitales y la pericia técnica, y de los gobiernos respectivos que controlan la riqueza mineral. Mientras los correspondientes acuerdos contractuales sean respetados por ambas partes, habrá la seguridad del continuo desarrollo mundial del negocio de petróleo.

Spanish

البترول ـ صناعة عالمية

لقد اصبح البترول حقاً صناعة عالمية ـ هذا مع العلم بان هذه الصناعة التي ما زالت في مطلع تقدمها قد اخذت تسير نحو تحقيق امكانياتها العظيمة الشاملة •

ان البترول الذي كان يستخرج غالباً من قطر واحد خلال مدة تزيد على نصف قرن قد انتشرت مواطنه الآن حتى صار حوالى نصف المنتوج منه يستخرج من مناطق متفرقة خارج الولايات المتحدة • وقد ثبت وجود سبعين في المائة من بترول العالم الاحتياطي في المناطق المستجدة •

وان سيل ناقلات البترول وكذلك خطوط الانابيب صارت تربط مصادر التموين النائية بمراكز الشحن والاستهلاك • كما ان اعمال التكرير اصبحت من المشاريع الصناعية المهمة في بلاد عديدة •

لقد كان البترول وسوف يظل اساس تعمير واصلاح ما دمرته الحرب كما انه سيبقى عماد الاهداف التي وضعت عقب الحرب لتحسين معيشة كافة البشر •

وان ما توصلت اليه مناطق عديدة من تقدم محسوس تم بفضل التعاون بين الحكومات التي تملك المواد المعدنية وبين الشركات الخاصة التي قدمت ما يلزم من رؤوس الاموال الضخمة والمعرفة الفنية •وطالما بقيت هذه الاتفاقات المعقودة موضوع احترام متبادل ورعاية مشتركة اصبح من المحقق استطراد نمو صناعة الزيت في العالم •

Arabic

GLOBAL INDUSTRY

IL PETROLIO – UN'INDUSTRIA MONDIALE

Il petrolio è effettivamente divenuto un'industria mondiale e si è appena agli inizi nella realizzazione delle sue potenzialità nel mondo intero.

I rifornimenti che per circa mezzo secolo può dirsi fossero centralizzati in un solo paese sono cosi largamente aumentati e diffusi che circa metà della produzione deriva ora da zone disparse al di fuori degli Stati Uniti. Il 70 per cento delle riserve mondiali si afferma che siano situate nelle zone petrolifere di più recente scoperta.

Navi cisterna e condotti convogliano i più lontani rifornimenti ai punti d'imbarco e centri di consumo. L'industria della ráffineria del petrolio è divenuta una importantissima impresa industriale in molti paesi. Le ricostruzioni del dopo-guerra e tutte le opere miranti ad un miglior standard di vita per tutti i popoli sono stati e continueranno a dipendere dal petrolio.

I successi del passato in molte zone sono stati raggiunti mercè la collaborazione di imprese private che hanno fornito i giganteschi capitali necessari e le abilità degli esperti in materia, e mercè il controllo delle sorgenti minerarie da parte dei governi. Fin quando gli esistenti accordi saranno mantenuti e rispettati in tale stato di collaborazione il continuo sviluppo dell'industria mondiale del petrolio sara assicurato.

Italian

LE PÉTROLE – UNE INDUSTRIE MONDIALE

Le pétrole est devenu une industrie vraiment mondiale – et il n'a que commencé sa pleine réalisation de ses potentialités mondiales.

Les gisements qui se trouvaient pendant plus d'un demi-siècle dans un seul pays, maintenant se trouvent un peu partout de façon qu'on trouve actuellement presque la moitié de la production dans des endroits en dehors des Etats-Unis. Soixante-dix pour-cent des réserves bien établies se trouvent dans les endroits nouveaux.

Les routes des bateaux pétroliers et les tuyaux d'aménagement relient les stocks aux centres d'envoi et de consommation. La raffinerie est devenue une industrie individuelle principale dans plusieurs pays. La reconstruction d'après-guerre et les but d'une nouvelle vie pour tous les peuples ont été et seront basés sur le pétrole.

Les réalisations du passé dans plusieurs endroits ont été accomplies par la coopération des compagnies privées qui offraient les énormes capitaux nécessaires et les connaissances indispensables et les gouvernements qui contrôlaient les minéraux. Aussi longtemps que ces accords contractés seront mutuellement respectés et observés, la pousée continuelle de l'industrie mondiale pétrolière sera assurée.

French

PETROLEUM – EINE WELTINDUSTRIE

Petroleum ist eine Weltindustrie geworden, die soeben im Begriff ist, sich ihrer Weltmöglichkeiten bewusst zu werden.

Bestände, die während eines halben Jahrhunderts und selbst länger auf ein einzelnes Land begrenzt waren, haben sich ausgebreitet, sodass heutzutage die Hälfte der Weltproduktion aus weitzerstreuten Gebieten ausserhalb der Vereinigten Staaten stammt. Siebzig Prozent der bekannten Weltläger befinden sich heute in neuerschlossenen Quellengebieten.

Tankerrouten und Rohrleitungen verbinden heute weitentfernte Förderungsquellen mit Schiffahrts- und Verbrauchszentern. Raffinierung ist in vielen Ländern zu einer Hauptindustrie geworden. Wiederaufbau- und Nachkriegsziele zur Hebung des Lebensstandards aller Völker waren und sind auf Petroleum angewiesen.

Die Erfolge der Vergangenheit wurden in vielen Ländern erzielt durch Zusammenarbeit zwischen Privatgesellschaften, die das notwendige Riesenkapital sowie die technischen Kenntnisse bereitstellten, und Regierungen, die die Rohmaterialen kontrollierten. Solange solch vertragliche Übereinkommen gegenseitig geachtet und befolgt werden, ist das weitere Wachstum der Weltölindustrie gesichert.

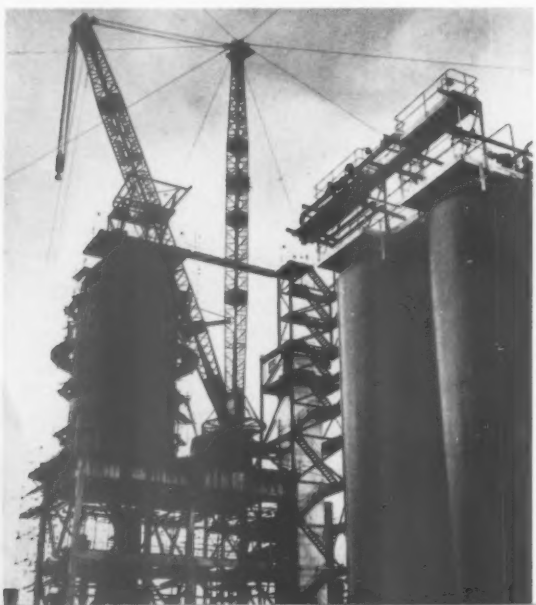
German

A Dyak surveyor at work in a jungle of Sarawak, B.E.I., for the Shell interests.

A launch of British Malayan Petroleum Co. brings supplies to a geological camp on the Kemena River in British Borneo.

OIL IS EAST AND OIL IS WEST

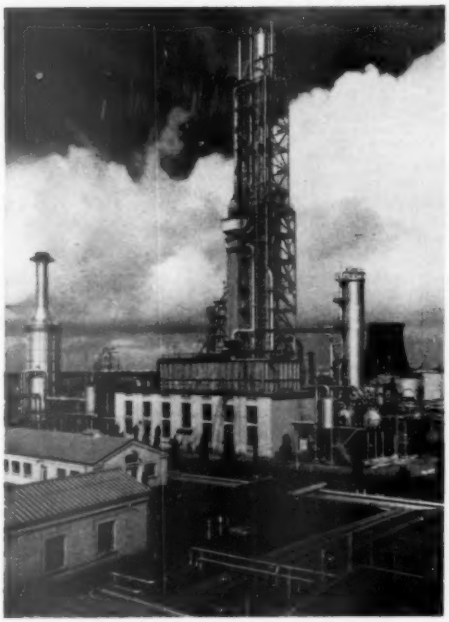
The past year has brought large gains in refining capacity of Great Britain and Western Europe. Here is a catalytic cracking unit under construction at the 50,000-bbl.-daily Grangemouth, Scotland, refinery of Scottish Oils, Ltd.



Here Imperial Oil, Ltd., is drilling a directional well in Joseph Lake field of Alberta, Canada.

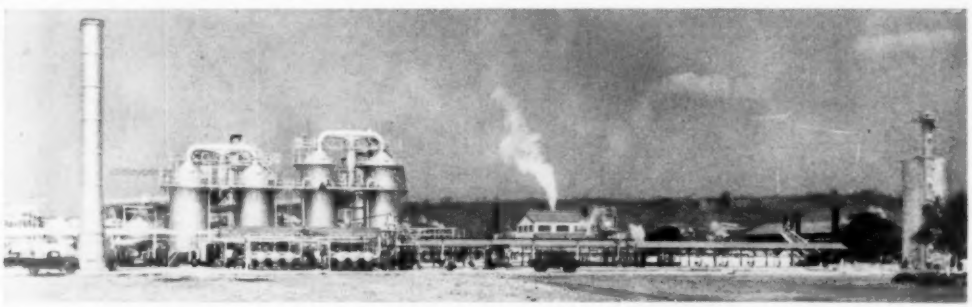
. . . and in oil the twain shall meet. Oil's domain knows no boundaries. All benefit from its widespread activities. These pictures and maps reflect in part the far-flung geography and diversified technology that make the industry what it is.

Houseboat living quarters of Caltex Pacific Oil Co., Sumatra, Indonesia.



New T.C.C. catalytic cracking plant of Deutsche Erdol-Antiengesellschaft, at Heide, Germany.

Extension test of Arabian American Oil Co. in the Abqaiq area of Saudi Arabia.

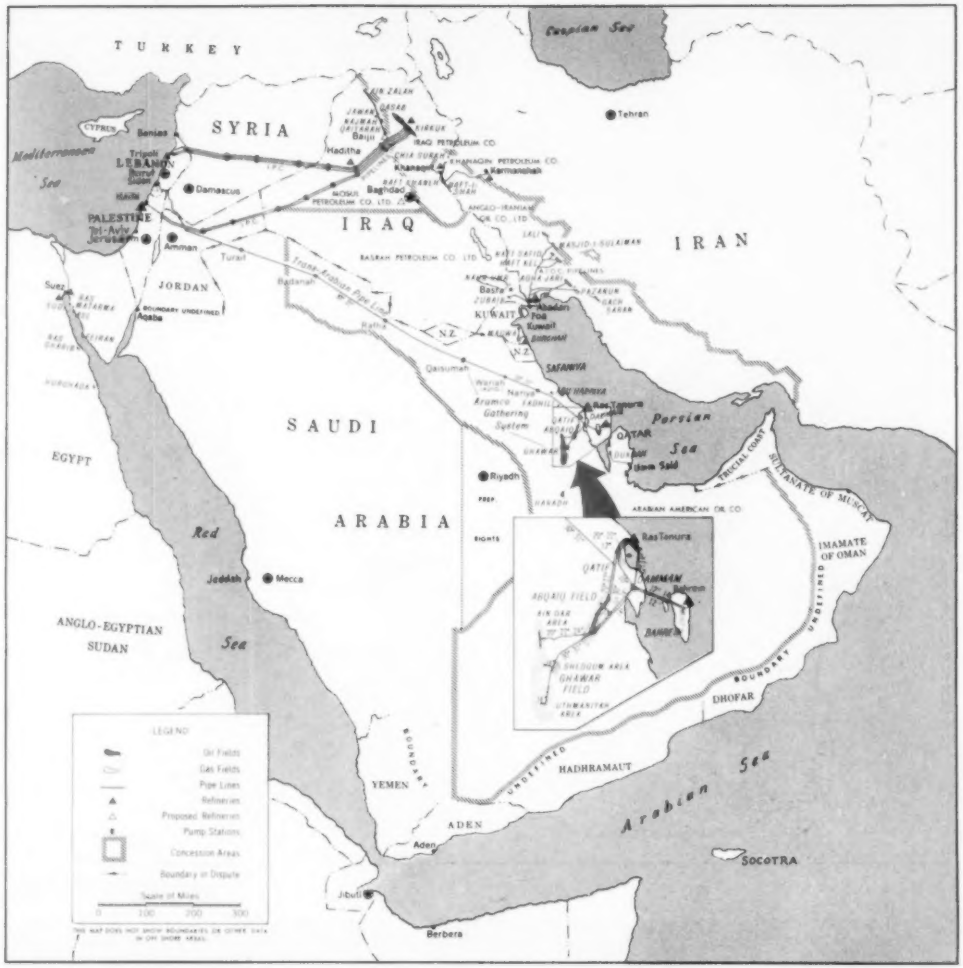


Byproduct operations are becoming more important in petroleum activities everywhere. This is a view of the sulfur plant of Petroleos Mexicanos, in Poza Rica field, Mexico.

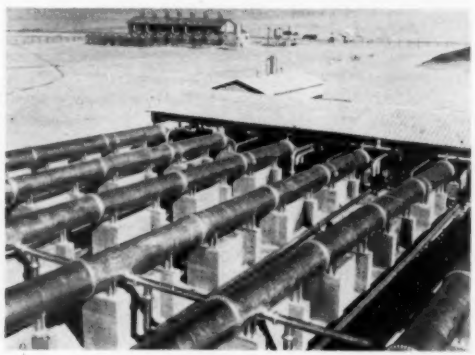
Field operations in Brunei, B.E.I., have been rehabilitated and expanded since the war's end. Here is a drilling crew at work in Seria field.

Iraq's Zubair field has become an important supplier of crude oil. This is the well head of a large flowing well.

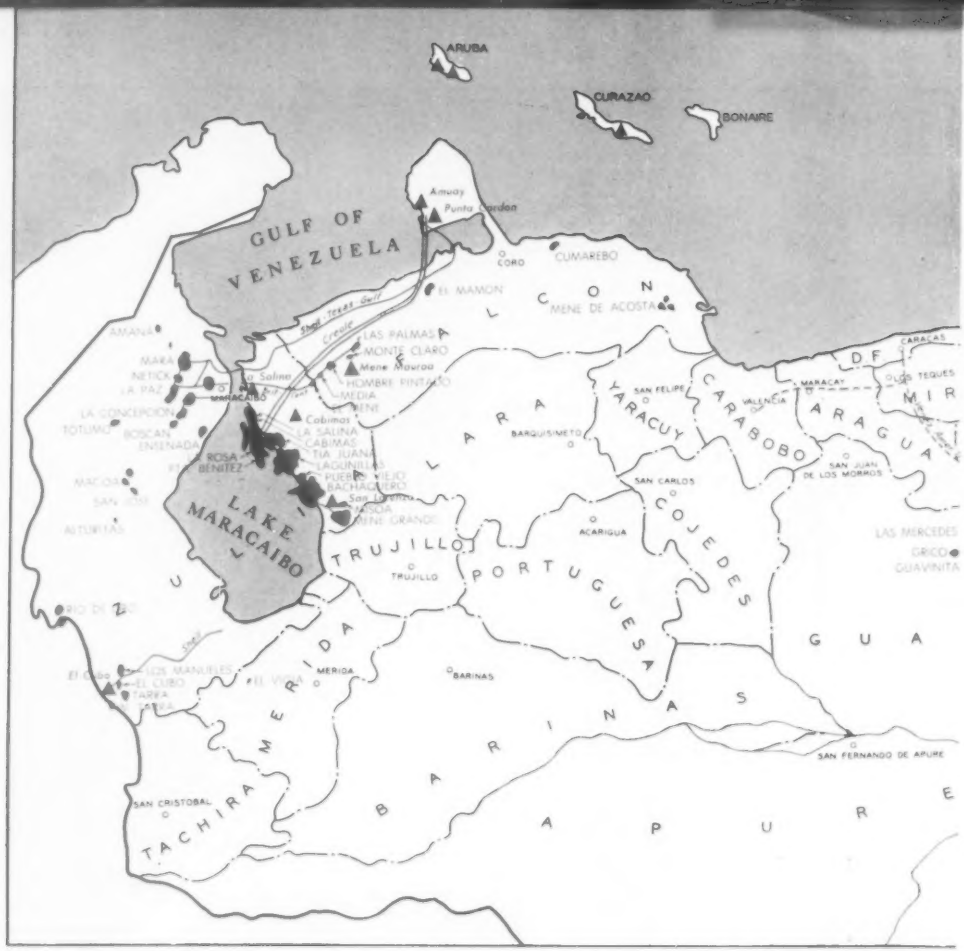
The Gage Lund of Caltex Pacific Oil Co. taking its first cargo of crude oil from the Pakning terminal at Sumatra, Indonesia.



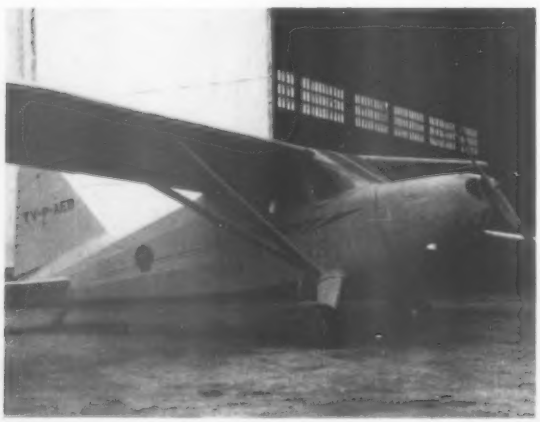
Oil-loading terminal of Kuwait Oil Co., Ltd., at Mina al-Ahmadi.



Horizontal oil-gas separators in Burgan field, Kuwait.



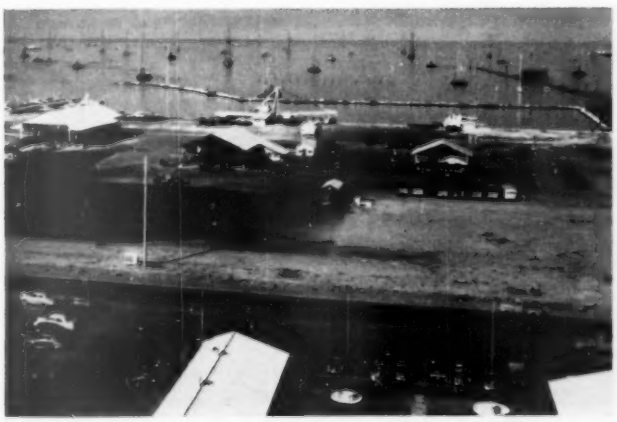
WESTERN VENEZUELA



Airplanes of many types are in constant use in foreign oil areas. This is one of the smaller planes of Shell-Caribbean Petroleum Co. in Venezuela.

Pile driver of Creole Petroleum Corp. driving concrete piles for a new location in the Lagunillas area of Venezuela.

EASTERN VENEZUELA



View of Tia Juana section of the famed Lake Maracaibo, Venezuela, producing area.

Negotiations for property acquisition in Trinidad.

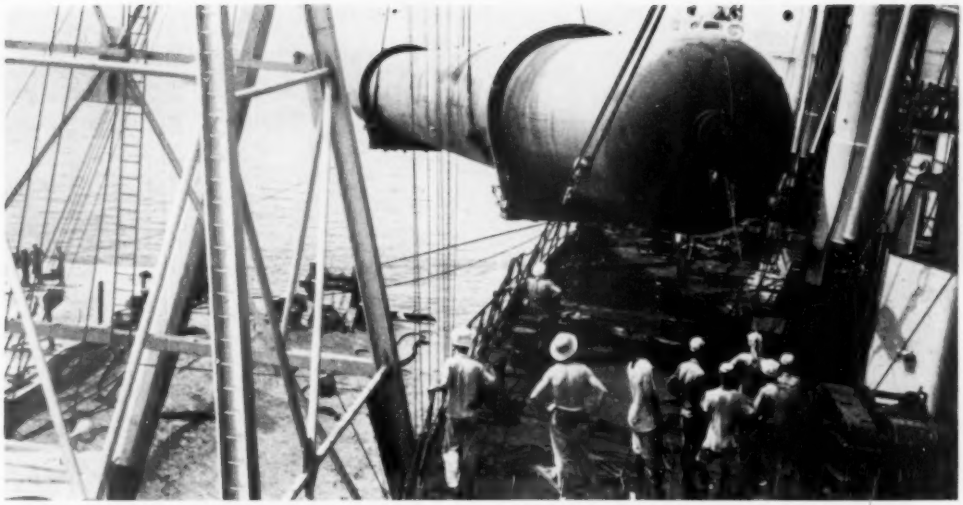
Exploration test of International Petroleum Co., Ltd., near Gamarra, Colombia.

The new 28,000-ton tanker of Anglo-Iranian Oil Co., Ltd., during a halt near the Suez Canal in Egypt.

Construction work on the 195-mile, 10 to 16-in. natural-gas line of Venezuelan Atlantic Transmission Corp. from El Placer to Caracas.

Construction view of the 45,000-bbl. refinery at Rho, Italy, of Condor, S.P.A. per l'Industria Petrolifera e Chemica.

The Punta Cardon, Venezuela, refinery of Shell Caribbean Petroleum Co. on the Paraguayan Peninsula. This is the largest of the postwar plants in South America and is now being expanded to 145,000 bbl. daily.



LOW-PRESSURE SEPARATING VESSEL for Abqaiq gas-oil separating plant No. 3 being unloaded at Ras Tanura, Saudi Arabia—the first time a completely assembled vessel had been shipped. The vessel measures 9 by 120 ft. Previously two 60-ft. halves had been field welded.

Field Processing of Arabian Crude Oil

Construction now under way on a gas-injection unit which will return 150 million standard cubic feet per day to formation in Abqaiq field

The Aramco Story . . .

Here's a brief outline of the history of Arabian American Oil Co. The facts that initial exploration work began less than 20 years ago and that tremendous increases in oil output have been possible, due in part to the great productivity of the flowing wells in Saudi Arabia, are quite well known. It is not so well known that operations were virtually at a standstill between 1940 and 1945, due to the war, or that most production increases of major significance have been made since that time. All of these facts are brought out by the chronology which follows:

September 1933	Geologists land at Jubail, near Ras Tanura.
December 1934	Drilling crew lands at Al Khobar, near Dhahran.
December 1937	Ten wells drilled; $3,000,000 spent, with no commercial show of oil found in Bahrein zone.
March 1938	Dammam No. 7, deep test, finds oil in Arab zone, making commercial production possible. Installation of facilities begins.
September 1938	Barge shipments of crude oil to Bahrein Petroleum Co. on Bahrein Island started.
May 1939	World War II begins; activities interrupted. Work continues wtih supplies on hand.
October 1940	Ras Tanura terminal refinery, 3,000 bbl. per day capacity, completed to supply products for local use.
November 1940	Abqaiq field discovered in Well No. 1, after location of high by structure drilling.
June 1942	American staff reduced to fewer than 100 to support necessary operations only.
September 1945	50,000 bbl. per day Ras Tanura refinery completed. Production for year 1945 averaged 58,390 bbl. per day.
January 1946	Initial Abqaiq field facilities completed and in temporary operation. Construction of additional facilities continues, to meet tremendous postwar increase in demand for crude oil. Production for year 1946 averaged 164,230 bbl. per day.
July 1948	Ain Dar area of Ghawar field discovered in first well drilled, confirming expectations from subsurface exploration work.
January 1951	Initial production from the Ain Dar area.
June 1951	Anglo-Iranian facilities shut down by nationalization. Aramco production and refinery runs increased to make up in part the loss of crude and products in markets of free world. Production for year 1951 averaged 761,500 bbl. per day, of which 175,000 bbl. per day being refined in Saudi Arabia at year end.

by Richard A. Boettcher

DRILLING, producing, and processing problems in Arabia are considerably different from those encountered in the United States. Some of these problems are brought about by the necessity of using native operators; others arise from characteristics of the crude oil and conditions under which operations must be conducted.

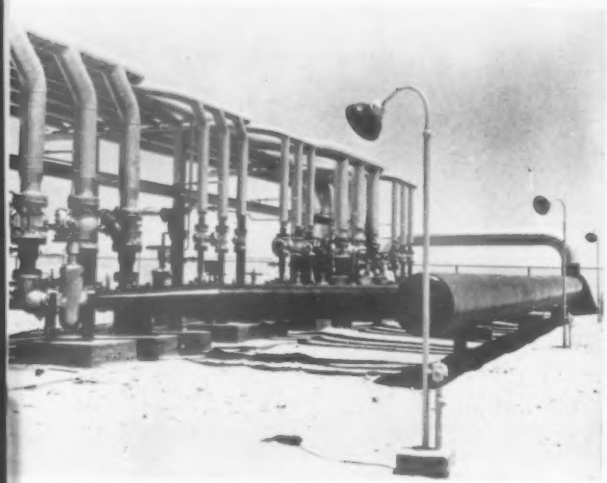
Large, horizontal separators are used almost exclusively by Arabian American Oil Co. in processing oil and gas in its Middle East fields. These multistage units provide the high capacities necessary when handling Middle East crude.

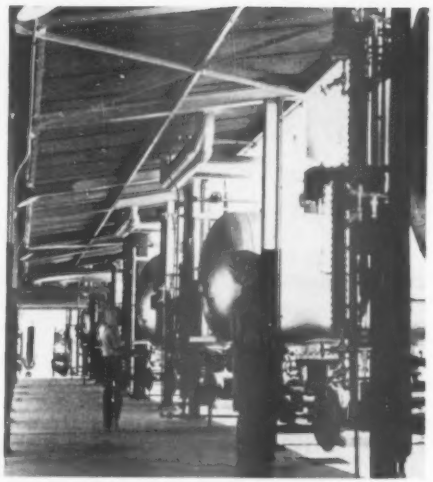
Additional crude processing in the field is provided for in stabilizers, which are steam-heated atmospheric weathering tanks. These vessels are used to remove propane and lighter from the crude. Hydrogen sulfide concentration is satisfactorily reduced in these units.

Aramco's production during June 1952 averaged 899,000 bbl. per day.

Operating Conditions Differ From Those in United States

Dammam field, near which the Aramco international community of Dhahran is located, was the first to be brought into production. Practices adopted in this field paralleled very





BACK-PRESSURE control station and liquid-level control station at Abqaiq gas-oil separator plant No. 3 in Abqaiq field. Note simplified and well-arranged piping. Such design features throughout the newer stations make it possible to operate them with all-Arab crews.

closely those in the United States, particularly West Coast fields, for most of the first drilling and producing personnel came to Arabia from California as members of California - Arabian Standard Oil Co., predecessor of Arabian American Oil Co. of today. However, a number of factors, among which were the nature of the operation, exclusive rights and special requirements of the concession agreement, terrain, and the characteristics of the wells themselves, made for a somewhat different solution to producing problems from the very beginning.

It was recognized immediately that practices made necessary by competitive drilling had no place in Arabia. When men, materials, and supplies—not only for the drilling operations themselves but also for the housing, feeding and recreation of all personnel involved—had to be transported halfway around the world, not a foot of hole could be wasted.

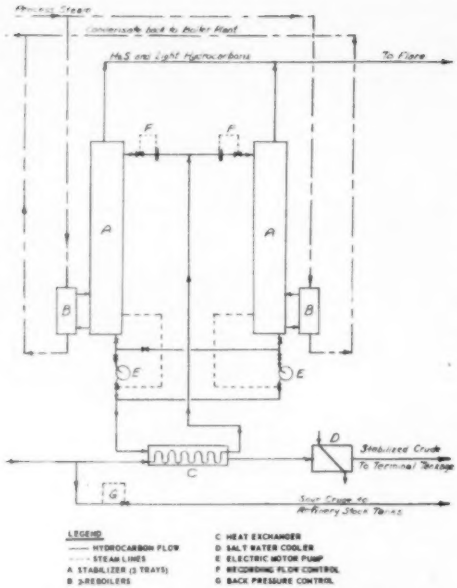
Well spacing was determined not by any arbitrary legislative standard but as a compromise between the necessity for exploration to outline and define the structure and requirements for development wells which would insure the most efficient over-all production of the reservoir. In the latter respect, the high permeability of the Arab zone (50 to 400 md.) together with production limitations imposed only by the requirements of good reservoir engineering practice, can be credited with making it feasible to adopt the wide spacings on which wells are drilled.

Gaging requirements also permit adoption of practices diverging rather widely from those in the United States. In Arabia it is the reservoir engineering problem and the problem of accounting for production, which make gaging of separator-station output or individual field production necessary. By agreement, crude oil must be gaged for royalty purposes prior to being charged to the refinery or being shipped from the country via pipe line or tanker.

Thus, royalty gaging is done only at Qaisumah, where oil is delivered to Trans-Arabian Pipeline Co.; at Ras Tanura, where it is refined and also shipped offshore in tankers; and at Dhahran, from where it is pumped via underwater pipe line to the Bahrein Petroleum Co. refinery on Bahrein Island. At these three locations, a total of 28 royalty gaging tanks is provided with a net working capacity of 3,800,000 bbl.

Other natural factors have their own modifying effects. Reservoir pressures, dictated by hydrostatic gradients, produce flowing wells, which, on initial tests, may show potentials as high as 20,000 bbl. per day. At normal producing rates, well-head pressures of 500-800 psi. or more are common. The exact magnitude, of course, depends

DAMMAM CENTRAL TRAPS . . . This battery of commercial, vertical separators is the first gas-oil separator plant installed in Arabia. First-stage vessels are to the left, second-stage to the right.



STABILIZER . . . Flow diagram of unit at Ras Tanura.

upon first-stage separating pressure, bean setting, and the size and length of flow line; but ordinary flow-line lengths up to 30,000 ft. are possible without the line size becoming excessive. In all locations the terrain is such that long flow lines present no undue construction difficulties.

Combination of the above circumstances favors a concentration of field facilities. It results in central separating plants with capacities as high as 200,000 bbl. per day and a thermal stabilizer for H_2S removal of over 500,000 bbl. per day capacity.

Pattern of Field Development

The initial program of development drilling in the Dammam field was completed more than 5 years ago. This included deepening of most of the original unproductive Bahrein zone wells. At the present time there are 23 producing oil wells within the proven area of the field, which is approximately 5 miles long and 4½ miles wide. A 200-250-acre minimum rectangular spacing was used, modified as necessary by fault conditions which exist throughout the formation. The resulting wells are no closer than 1,500 ft. nor farther apart than 3,700 ft.

Gas-oil separation is done at a central station of 90,000 bbl. per day capacity, located near the midpoint of the field, 12,000 ft. from the most distant well. Field production for the second quarter of 1952 averaged 61,900 bbl. per day, which when prorated equally to all wells gives a production per well of about 2,700 bbl. per day. Actual production of the majority of wells is somewhat greater than this, as a number of flank wells are shut back to avoid excess production of formation water.

Qatif field . . . Exploration of Qatif field is only now entering its final phase, after having been produced since 1945. This also is a relatively small field by Middle East standards, being approximately 12 miles long and 5 miles wide. The nine producing wells are confined to exploration holes along the axis and on a middle and northern cross-section. Spacing between wells ranges from 5,000 to 10,000 ft.

Three small separating stations, each of 20,000 bbl. per day capacity, are provided along the axis of the field to equalize withdrawals from the tight (approximately 50-md. permeability) producing formation. The maximum length of flow line in this field has been held to 10,000 ft. Second quarter 1952 field production was 41,700 bbl. per day, an average of 4,600 bbl. per day per well.

Abqaiq field . . . Largest of the proven Saudi Arabian fields is Abqaiq. It is 32 miles long by 6 miles wide. This is the field which made possible the phenomenal growth experienced by Aramco as a result of unprecedented postwar oil demand. Even now, almost 7 years after initial production was taken from Abqaiq, it still supplies the major portion of Aramco's output. Except for a low-relief northern tip, the field is now completely developed, with a total of 62 producing wells. The first 10 of these were purely exploratory, establishing a line down the major axis and a transverse line near the minor axis.

Development of the main anticline then proceeded with two "rings" of wells—one on the 6,000-ft. subsea contour and the second on the 6,500-ft. contour. These rings vary from 5,000 to 15,000 ft. apart at the minor and major axes, respectively, of the elliptical structure. On the inner ring 20 wells were drilled, spaced a nominal 4,500 ft. apart; on the outer ring there are 18 wells approximately 8,500 ft. apart. In the northern area there are 14 wells, roughly 10,000 ft. apart on what amounts most nearly to a block area spacing.

As at Qatif, three central gas-oil separating stations are provided. One is located in the flat northern area, and two in the main part of the field. The latter two stations each have two separating units nominally rated at 100,000 bbl. per day apiece. The northern station has a single similar unit, for a daily combined field separator capacity of 50,000 bbl. Flow lines into these stations from outlying wells may be as long at 30,000 ft.

During the second quarter of this year production averaged 461,000 bbl. per day, a daily average per well of over 7,400 bbl. However, from wells in the northern area, which has only been produced during the last 3 years, actual production was considerably higher, approaching 10,000 bbl. per day, in order to equalize pressure decline throughout the reservoir prior to gas injection. A most interesting article by P. C. McConnell, Aramco's assistant general manager of oil operations, dealing in detail with the Abqaiq field de-

SUMMARY OF CHARACTERISTICS—Unstabilized Aramco Crude Oil

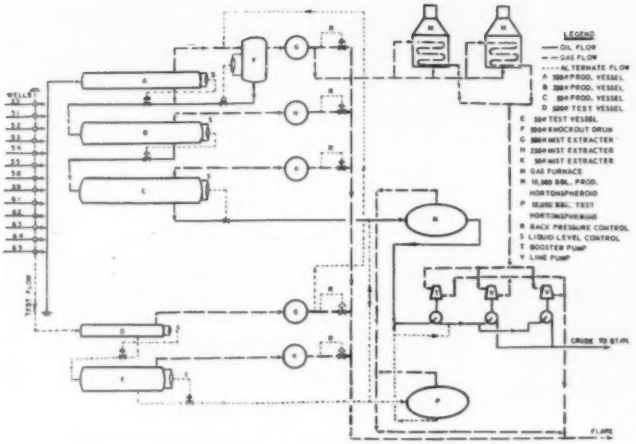
	Gas/Oil Ratio Std. Cu. Ft./Bbl.	A.P.I. Gravity	Reid Vapor Pressure	Viscosity SUS @ 70° F.	Hydrogen Sulfide p.p.m
Dammam	460	35.0	4.0- 5.5	49.0	75-200
Qatif	525	35.0	8.0-10.0	55.0	650-850
Abqaiq	875	37.5	6.5-10.0	44.5	125-350
Ain Dar	610	35.0	6.5- 8.5	54.0	75-200

THE AUTHOR

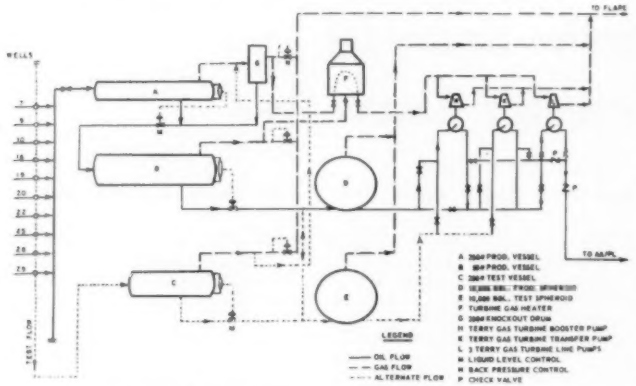
Richard A. Boettcher is located in the New York office of Arabian American Oil Co. as staff engineering adviser to the vice president in charge of technical and supply services. Following graduation from University of Wisconsin, he worked with Standard Oil Co. of California as refinery engineer on many phases of engineering, construction, and maintenance. In 1947 he received a master of science degree from California Institute of Technology, and in the same year he qualified in California as a professional civil engineer. At that time he transferred to Aramco.

SUMMARY OF ARAMCO GAS-OIL SEPARATOR PLANTS

	Stages of separation	Production vessels and separating pressures — First stage	Second stage	Third stage	Fourth stage	Rated cap., bbl./day	No. of wells connected	Flowlines — Size (in.)	Flowlines — Max. length (ft.)
Dammam—									
Dammam Central Traps:									
Unit No. 1—Sept. 1938	4	6—3x16 ft. Vertical in parallel at 335 psi.	2—5x12 ft. Vertical in parallel at 140 psi.			10,000			
Unit No. 2—Jan. 1941	4	6—3x16 ft. Vertical in parallel at 335 psi.	2—5x12 ft. Vertical in parallel at 140 psi.	4—9x30 ft. Horizontal in parallel at 60 psi.	10,000 bbl. Spheroid or thermal stabilizer at 2-3 psi.	10,000	23	4	12,000
Unit No. 3—Aug. 1945	4	2—4x60 ft. Horizontal in series at 300 psi.	2—4x60 ft. Horizontal in series at 140 psi.			70,000			
Qatif—									
Qatif G.O.S.P. No. 1:									
Unit No. 1—July 1945	3	2—3x16 ft. Vertical in parallel at 250 psi.	1—5x16 ft. Vertical at 50 psi.	45x40 ft. (11,000 bbl.) Cone-roof tank at 5 in. H_2O		2,000	Converted for well testing in 1948		
Unit No. 2—Feb. 1948	3	1—4x60 ft. Horizontal at 250 psi.	1—9x60 ft. Horizontal at 50 psi.	45x40 ft. (11,000 bbl.) Cone-roof tank at 5 in. H_2O		20,000	Orig. 4 Now 2	4 and 6	17,000
Qatif G.O.S.P. No. 2—Jan. 1952	3	1—4x40 ft. Horizontal at 250 psi.	1—4x40 ft. Horizontal at 30 psi.	5,000 bbl. Cone-roof tank at 1-1½ psi.		20,000	4	4	6,000
Qatif G.O.S.P. No. 3—Feb. 1952	3	1—4x40 ft. Horizontal at 250 psi.	1—4x40 ft. Horizontal at 30 psi.	5,000 bbl. Cone-roof tank at 1-1½ psi.		20,000	3	4	10,000
Abqaiq—									
Abqaiq G.O.S.P. No. 1:									
Unit No. 1—May 1946	4	3—4x60 ft. Horizontal in parallel at 500 psi.	2—4x60 ft. Horizontal in parallel at 150 psi.	3—9x60 ft. Horizontal in parallel at 65 psi.	10,000 bbl. Spheroid at 5 psi. or Thermal Stabilizer at 20 psi.	75,000			
Unit No. 2—Sept. 1947	4	1—5½x120 ft. Horizontal at 500 psi.	1—5½x120 ft. Horizontal at 150 psi.	1—9x120 ft. Horizontal at 65 psi.	10,000 bbl. Spheroid at 5 psi. or Thermal Stabilizer at 20 psi.	80,000	30	4 and comb. 4-6	30,000
Abqaiq G.O.S.P. No. 2:									
Unit No. 3—April 1948	4	1—5½x120 ft. Horizontal at 500 psi.	1—5½x120 ft. Horizontal at 150 psi.	1—9x120 ft. Horizontal at 50 psi.	10,000 bbl. Spheroid at 5 psi.	100,000			
Unit No. 4—Nov. 1948	4	1—5½x120 ft. Horizontal at 500 psi.	1—5½x120 ft. Horizontal at 150 psi.	1—9x120 ft. Horizontal at 50 psi.	10,000 bbl. Spheroid at 5 psi.	100,000	20	4 and comb. 4-6	27,000
Abqaiq G.O.S.P. No. 3—May 1950	4	1—6x120 ft. Horizontal at 500 psi.	1—5½x120 ft. Horizontal at 150 psi.	1—9x120 ft. Horizontal at 50 psi.	10,000 bbl. Spheroid at 5 psi.	100,000	12	4 and comb. 4-6	30,000
Ain Dar—									
Ain Dar G.O.S.P. No. 1—Jan. 1951	3	1—6x120 ft. Horizontal at 300 psi.	2—9x60 ft. Horizontal in parallel at 50 psi.	10,000 bbl. Spheroid at 5 psi.		100,000	10	6	19,000
Ain Dar G.O.S.P. No. 2—Oct. 1951	3	1—6x120 ft. Horizontal at 300 psi.	1—9x120 ft. Horizontal at 50 psi.	10,000 bbl. Spheroid at 5 psi.		100,000	11	6 and comb. 6-8	24,000
Ain Dar G.O.S.P. No. 3—Jan. 1952	3	1—6x120 ft. Horizontal at 300 psi.	1—9x120 ft. Horizontal at 50 psi.	10,000 bbl. Spheroid at 5 psi.		100,000	12	6 and comb. 6-8	24,000
Ain Dar G.O.S.P. No. 4—Oct. 1952	3	1—6x120 ft. Horizontal at 300 psi.	1—9x120 ft. Horizontal at 50 psi.	10,000 bbl. Spheroid at 5 psi.		100,000	12	6 and comb. 6-8	26,000



GAS-OIL SEPARATOR PLANT... Flow diagram of unit at Abqaiq.



GAS-OIL SEPARATOR PLANT... Flow diagram of unit at Ain Dar.

velopment, appeared in the December 20, 1951, issue of The Oil and Gas Journal.

Ain Dar is the newest of the Saudi Arabian fields, having been discovered in July 1948. By the end of this year initial development will be complete, and it is expected that 45 wells will be producing from a proven area roughly the size of Abqaiq field. Exploratory and development drilling in this area followed much the same pattern as established for Abqaiq, except that only one ring of development wells was drilled because of the lesser height of oil column. Spacing between wells is about 10,000 ft.

Wells are flowed into four central gas-oil separating stations, each with one separating unit of 100,000 bbl. per day rated capacity. Because of the additional station, as compared to Abqaiq field, maximum lengths of Ain Dar flow lines are under 25,000 ft. Also, the flow lines are of larger size in general, making potentials of the Ain Dar wells higher than any others in Arabia. Ain Dar production during the second quarter 1952 was 306,400 bbl. per day, with each producing well averaging somewhat in excess of 10,000 bbl. daily.

Continuing exploration south and east of the original Ain Dar structure is in progress.

Original Separator Development at Dammam

Gratifying as the discovery of commercial oil at Dammam was to backers of the initial Arabian venture, their 4-year history of unsuccessful drilling had made them understandably conservative about future prospects. Therefore, the first setting of gas-oil separators built in September 1938 was designed to process only 10,000 bbl. per day. This was a central setting, selected after a careful analysis of many other gathering system alternatives and based on field testing, which showed that the gas-oil ratio, while high, was not sufficiently high to make well-head separation mandatory.

Provision was made to accommodate up to 10 flow lines, each of which could be connected to a small test separator for individual well testing, or to the production facilities. Following accepted United States practice for the well-head pressures encountered, three-stage separation was decided upon, with first and second-stage pressures of 335 and 140 psi. respectively. The final separation at 60 psi. was designed to be accomplished in surge drums at the stabilizing plant, from which the stabilizer columns were to be fed directly.

Conventional vertical separators were used—six 3 by 16 ft. in parallel for the first stage and two 5 by 12 ft. in parallel for the second stage. Surge tanks and third stage separators were three 9 by 30-ft. horizontal vessels in parallel. This arrangement proved to be economical and very workable, particularly since no pumping was required until after the stabilization process. Thus, it was, even though not specifically intended, that the very first Aramco separators made use of horizontal gravity-type separating vessels, a practice which later was to become so successful in Arabia for achieving high-rate, gas-oil separation.

However, the use of horizontal gas-oil separators cannot be claimed to have originated with Aramco. As early as 1930, Anglo-Iranian Oil Co. had in operation at its Haft Kel field horizontal separator units, or "stabilizers" as referred to by the British, with central station capacities of 40,000 bbl. per day.[1]

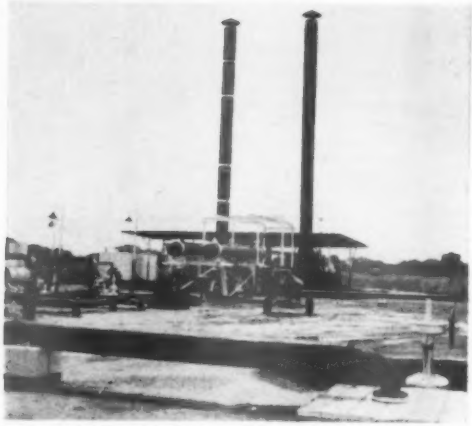
As a brief resume it might be sufficient to state that the Haft Kel units, and later variations used at Gach Saran, Agha Jari, and other fields, employ from six to eight stages of separation. In the earlier units 3 by 60-ft. horizontal well-head separators operating at about 500 psi. are provided, from which the oil gravitates to a battery of five horizontal 4-ft. 6-in. by 120-ft. vessels operating in series at pressures from 200 down to 25 psi.

The newer units are of greater capacity, vessels are larger, and are all located at the central setting. The vessels are also inclined slightly from the horizontal to improve gas and liquid draw-off conditions. In the latest designs nine

(Continued on page 332)

1. H. S. Gibson, Anglo-Iranian Oil Co., "Multistage Stabilization of Crude," Petroleum Technology, August 1939. Technical Paper 1085 of A.I.M.E.

View showing 240-in. polished-rod-stroke experimental unit, with a 35,000-psi. maximum load capacity.



View of heating station No. 17, the station that heats crude at midpoint of its journey to loading terminal.

How Richmond Handles Heavy-Oil Production in Venezuela's Boscan Field

Drilling here is routine; it's moving the product to a loading terminal that poses major obstacles

by R. A. Armstrong*

SITUATED approximately 30 miles southwest of Maracaibo, in a veritable jungle, lies Boscan oil field. From its 72 wells Richmond Exploration Co. produces a daily average of 25,000 bbl. of 10.5° A.P.I. asphalt crude, which is equivalent to the amount of asphalt used to pave about 30 miles of two-lane highway every day.

This crude has a viscosity ranging from 17,000 to 48,000 S.S.U. at 122° F, and must be pumped 25½ miles to a loading dock for shipment. Such a feat incurs many problems, and it is the purpose of this article to sketch briefly the processes involved and to review some of the major problems encountered in handling this extremely heavy viscous crude and how they have been overcome.

Drilling operations . . . An average Boscan well is drilled with a Gel-Slip mud to approximately 7,100 ft., at which point the Gel-Slip is converted to red mud and the hole is continued to a total depth of ±7,800 ft., penetrating the Oligocene and Eocene sand formations at depths of 6,500, and 7,400 ft., respectively.

The wells are drilled on a 214-acre spacing program and the oil in place is propelled by what is believed to be a solution gas drive.

An average Boscan well is cased with 13⅜-in. surface pipe to 500 ft. with an 8⅝-in. oil string set at approximately 7,500 ft. A 6⅝-in. 60-mesh slotted liner is then hung in the 8⅝-in. and extends to total depth.

The drilling of Boscan wells is not a difficult task; it is after the well is drilled and it is desired to transport economically the heavy crude from the well bore to a loading terminal that the major obstacles are encountered.

After the aforementioned liner is hung, a string of 4½-in. o.d. E.U.E. tubing and a 4-in. deep-well pump having a 3¾-in. bore is run to a depth of about 3,000 ft.

Producing problems . . . Due to the extremely high viscosity and weight of

Boscan gathering station with storage tank, boilers, and gas-oil separator with weightmeter.

*Petroleum engineer, Richmond Exploration Co., Maracaibo, Venezuela.

the crude, and the depth from which the crude must be lifted, a major pumping problem arises in moving an average of 500 bbl. per day from the well bore.

Field experience has indicated that the above factors, coupled with a tubing-head pressure of around 100 psi. will tend to exert a prohibitive rod stress under normal operating conditions; consequently in order to reduce the resulting peak load, it is necessary to employ 6 or 8-in. flow lines and to maintain gas-oil separators at a minimum practical pressure.

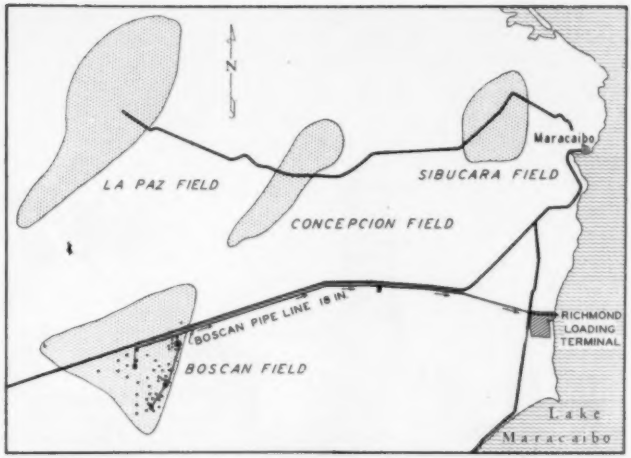
The use of such abnormally large flow lines, which vary in length from 5,817 to 574 ft., depending on the distance from the well head to the nearest gathering station can be understood upon the realization that large flow lines are necessary in order to maintain a frugal control between the number of wells drilled, and the daily volume output of these wells.

By maintaining an average minimum practical pressure of 30 psi. on the gas-oil separators, the back pressure on the well head is consequently minimized, thus further reducing the stress on the rods in the well bore. This minimum pressure is sufficient to lift the crude into 5,000-bbl. tanks located at the gathering stations and permits the utilization of economically sized gas lines which are used to transport fuel gas to the prime-mover engines at the well locations.

Pumping units . . . The pumping units employed on Boscan wells are the air counter-balanced type with gear-box torque capacities ranging from 456,000 to 750,000 in.-lb., and beam load capacities from 30,000 to 40,000 psi. Field experience with these units operating at an average of 8 s.p.m. and a polished-rod stroke varying between 100 and 144-in. has proven satisfactory. However, experiments are now being conducted with a 240-in. polished-rod stroke hydraulic pumping unit having a 35,000 psi. maximum load capacity, the results of which have been inconclusive as of this writing.

An interesting but somewhat provoking incident involving the lifting of Boscan crude concerns the starting of the pumping units after a well has been shut in for about 24 to 36 hours. This is a sufficient amount of time to permit the temperature of the crude in the upper extremities of the tubing to approach that of the surrounding ground so that the rods will not fall freely through the resulting extremely viscous crude.

Thus, a condition arises wherein the horse head is moving in an upward direction while the rods are still falling. Although various remedies have been tried, the most economical procedure necessitates manual control of the unit's clutch until such time that the temperature of the warm ascending crude has reduced the viscosity sufficiently to permit the free falling of the rods.



Boscan field in 30 miles southwest of Maracaibo. Its 72 wells produce a daily average of 25,000 bbl. of asphalt crude.

Crude transportation . . . Beginning with an average temperature of 118° F. at a depth of 3,000 ft. in the well bore, Boscan crude undergoes a constant heating program, thus further facilitating the movement of the crude on its 25-mile journey from the well head to the lake tanker-loading dock by virtue of the fact that the effect of said heating of this crude tends to reduce its viscosity approximately 50 per cent with each 20° F. increase in an almost straight-line curve.

Because of this radical variation in viscosity it is not uncommon to experience increases in pressure drop ranging up to 100 psi. along the flow lines during the night by virtue of the change in atmospheric temperature be-

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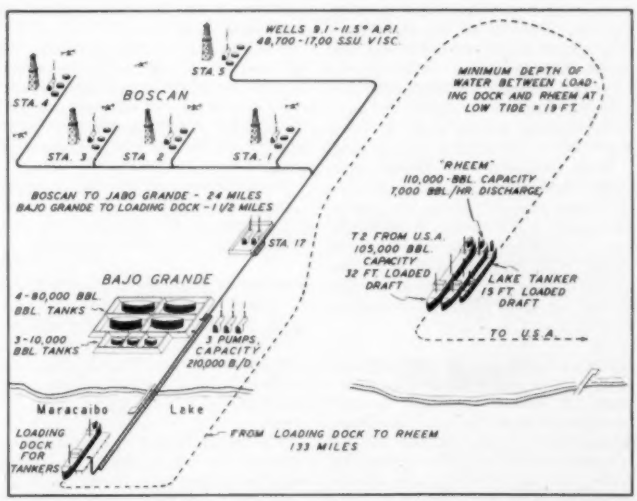
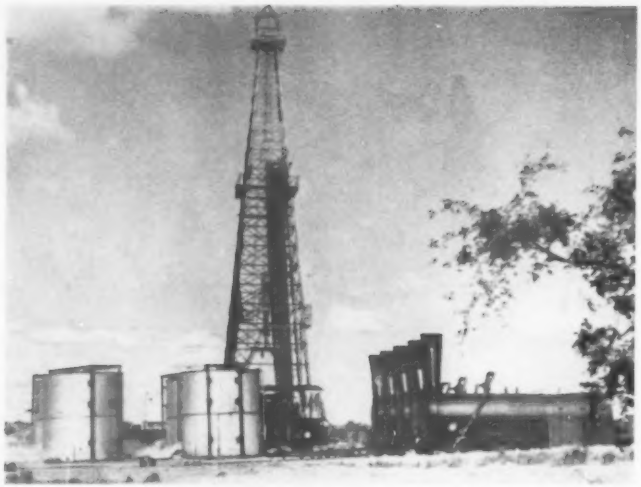


Boscan crude is pumped 25 miles from well to lake tanker-loading dock. Lake tankers then transport it 133 miles to Rheem, at which point it is transferred to a T2 tanker for shipment to the United States.



A SOCONY RIG on location in Venezuela.

Socony Reduces Drilling Time in Guario by Directional Drilling

by F. A. Maretich and S. K. Wilkie

GUARIO field is located in the central part of the State of Anzoategui, Venezuela. The Guario dome is a long northeast-southwest trending anticline, bounded on the south by a major thrust fault. The dip of the beds on the flank are steep, averaging 30°-40°. The presence of soft shales, and relatively harder stringers of sand, throughout the section, make it almost impossible to maintain a straight hole.

Wells drilled to the deeper sands in this field encountered high-pressure salt water and gas sands, lost-circulation zones, and extremely hard formation. To eliminate hole trouble in the deeper parts of the field, the holes were maintained as vertical as possible through the upper Moreno and Naranja sections (see Fig. 1).

Drilling program . . . In the latter part of 1950, a drilling program was undertaken to develop a shallow reservoir lying on the south flank of the Guario dome. Due to the fact that this development was likely to necessitate drilling several wells it was decided to make a thorough study of the data available with the aim of developing the optimum technique for drilling to this reservoir. Data were assembled on four wells drilled to this reservoir in order to determine the effect of various factors on the time required to drill these wells.

Time studies showed that about 70 per cent of the time was spent on the bottom drilling. This indicated that any sizable reduction in the time required to complete a well would have to be effected by an increase in penetration rates.

It was recognized that the principal factors affecting penetration rates were (1) equipment, (2) personnel, (3) formation, and (4) drilling technique.

Formations penetrated . . . As factors (2) and (3) were fixed, and the time study indicated only minor changes could be effected by any feasible change in the surface equipment, a study was made of the drilling technique as related to the formations penetrated.

The section drilled in this area consists of the Oficina formation which underlies a thin layer of the Sacacual. The first member penetrated after drilling out from under the surface pipe is the Azul, which consists dominantly of interlaminated dark-gray silty shale and light-gray fine-grained micaceous shaly sandstone. Also included are thin limestones, greenish and brownish claystones, lignite shales, and streaks of lignite. This section is characterized by an alternation of marine and brackish-water fossiliferous beds.

The Moreno member consists of dark gray fissile shale, but includes some thin calcareous sandstones, limestones, lignites, and green claystones.

The Naranja member consists largely of gray fissile shale, interlaminated shale, and sandstones, and includes thin sandstones, lignites, limestones, and claystones. The formations are steeply dipping to the southeast at angles ranging from 24°-42°.

The slow penetration rate had been the result of trying to maintain a vertical hole while drilling through these formations. It is known that broken formations (stratification of hard and soft layers) that are steeply dipping have a tendency to deviate the hole updip. The generally accepted method of keeping a hole within normal limits of deviation was to use a very light drilling weight, 500 to 1,000 lb., and fast rotation of the rotary table, 165 r.p.m.

Penetration Rates

In general, it was recognized that the factors affecting penetration rates and ability to keep the hole vertical included the following:

1. **Type of bit**—Exhaustive analysis of this factor showed little discernible difference among the various types of bits run. In all, nine types of bits were tried.

2. **Rotary speed**—No attempt was made to correlate rotary speed with other variables for two reasons. First, the data available were fragmentary, and secondly those available indicated that this factor was relatively constant.

3. **Circulating rate**—While ample circulation is required it would not be a controlling factor in rate of penetration for this particular area.

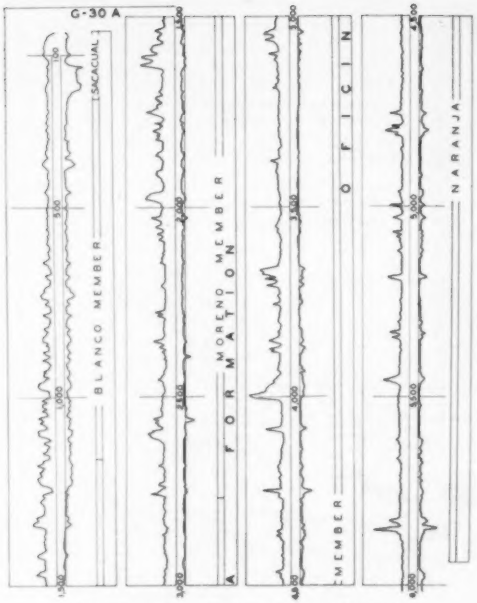
4. **Mud program**—The use of oil emulsion mud resulted in an increase of the penetration rate.

5. **Weight carried on bit**—The controlling factor in determining penetration rate was the amount of weight carried on the bit. Within the limits of the investigation, it was found that the relationship between penetration rate and bit weight was given by the following equation:

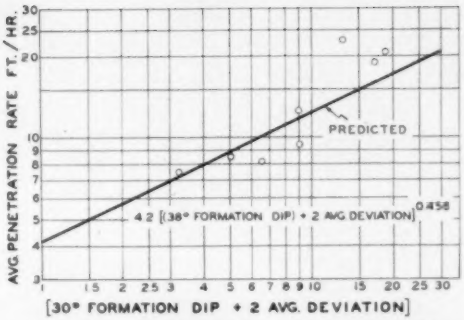
$$\text{Penetration rate} = K\ (\text{bit weight})^{2.73} \quad (1)$$

The complicating factor arose from the fact that the rate of deviation also varied as the rate of penetration, or:

$$(d\theta/dD)_{rs} = f(dD/dt)$$



LOG OF WELL drilled in Guario field. Fig. 1.



AVERAGE PENETRATION RATE curve for wells drilled in Guario field. Line is predicted from the equation, while points show actual rates. Fig. 2.

THE AUTHORS

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Petroleum engineers, eastern division, Socony-Vacuum Oil Co. of Venezuela.

where
θ = deviation
D = depth
Fb = formation dip
t = time

In order to solve this equation the average dip of the last three wells drilled was taken as 30° and the equation solved for a total well depth of 5,000 ft. In order to extend the use of the equation to other formation dips an additional factor was introduced which led to the final expression:

$$\text{Average penetration rate} = 4.2\,[(30° - \text{formation dip}) - \text{average deviation}]^{0.460}$$

It will be realized that this equation has limitations due to the many assumptions made in solving the original differential equation. First, what is obviously a tangential function of an angle has been assumed to be directly proportional to the angle, which is approximately true only over certain ranges. Other assumptions are that the number of hard and soft sections will be the same and will be of the same dimensions, and that the dip of the entire section drilled will be directly proportional to the formation dip at final depth. In cases where the first term, (30° — formation dip) is negative, it was assumed to be equal to zero. All positive values were assumed to be valid.

The deductions drawn from this equation were that the allowable final deviation was extremely critical in determining the penetration rates. For example, for a formation dip of 30° the penetration rate would increase by a factor of 1.4 if the allowable deviation were increased from 1° to 2°.

6. **Drill collars**—The number of drill collars had been varied from 3 to 12. Both 6¾ and 6⅛-in. drill collars were

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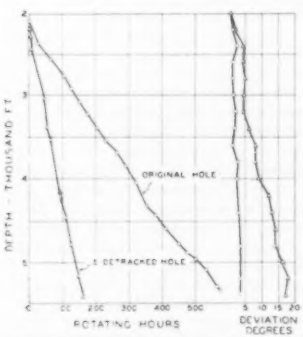
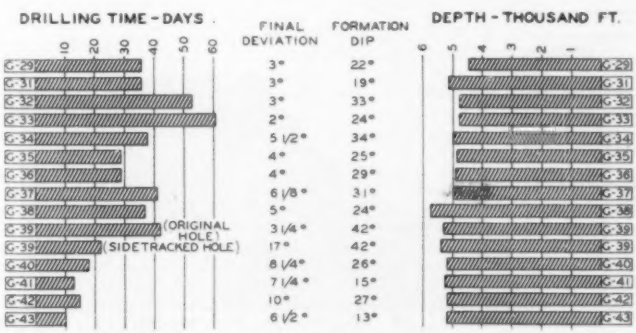
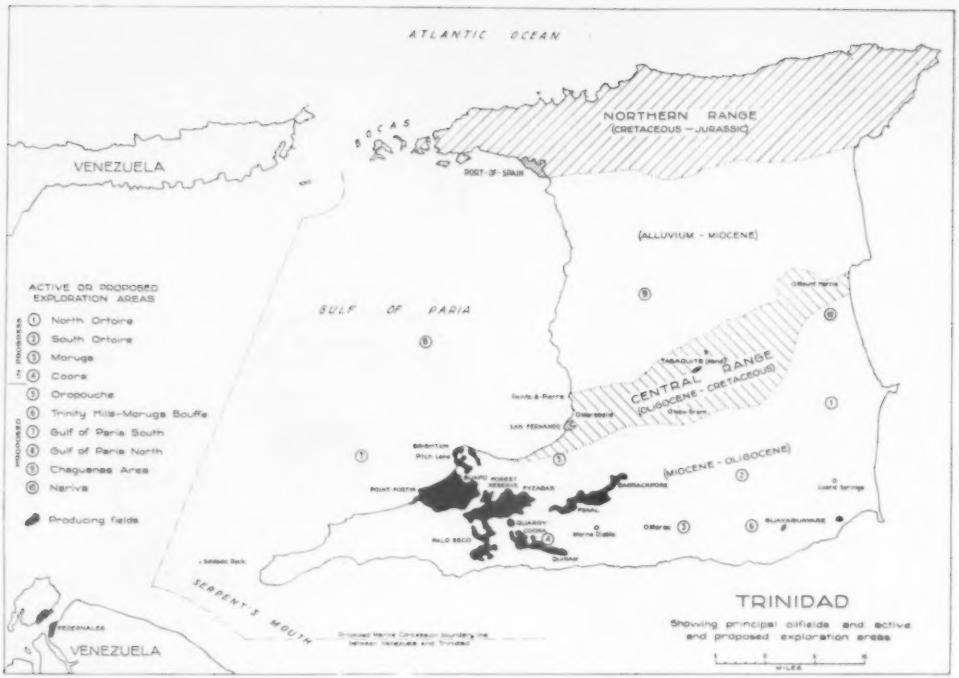


ROTATING HOURS required to drill original and side-tracked holes. Fig. 3.



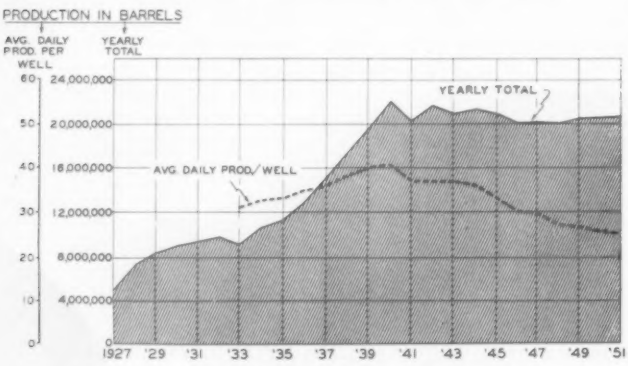
DAYS REQUIRED to drill wells; well depths; maximum deviation; and formation dip. Fig. 4.



All of Trinidad's producing fields are located in the southern half of the island and all recent exploration drilling has been confined to this region.

Search for New Productive Areas Is Intensified in Trinidad

Over the past 6 years production has remained steady and annual completions have been fairly constant. Last year's production: 20,000,000 bbl.



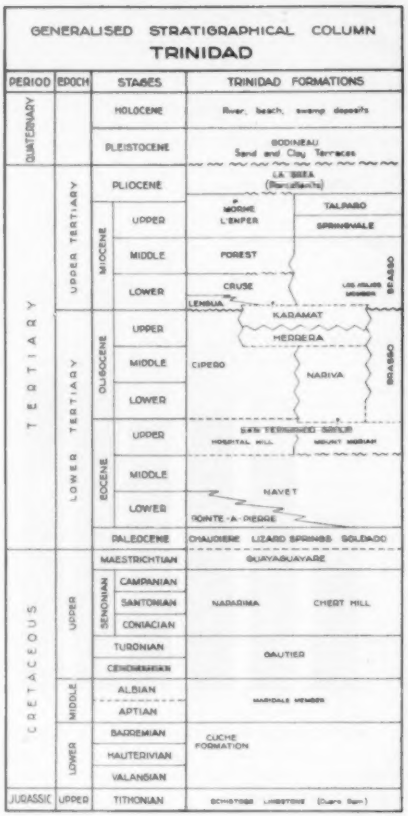
Annual crude-oil production in Trinidad.

THE last discovery of a new area of major importance in Trinidad came in 1936. The fact that production has only just been maintained in spite of the relatively high number of new completions has spurred efforts of oil companies in their search for new productive areas.

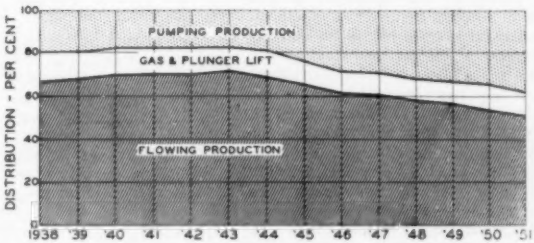
The depleting nature of the existing reservoirs is illustrated by the drop in average daily production from about 40 bbl. per day per producing well in 1940 to 25 bbl. per day in 1951. At present there are 584 flowing wells accounting for almost 50 per cent of the production, and 1,696 wells on artificial lift (including gas lift, plunger lift, pumping, and other methods).

The average production per flowing well is 48.5 bbl. per day, and 16.7 bbl. per day per pumping well.

Production sources . . . The larger part of Trinidad's production has come and is still being obtained from the Morne l'Enfer, Forest, and Cruse sands of Miocene age, normally found at comparatively shallow depths down to 4,500 ft. The Nariva sands, usually ascribed to the Oligocene but considered by some geologists to be Miocene, have also yielded some commercial production on a small scale,



Road preparation through jungle to wildcat location.



Crude-oil production methods in Trinidad, showing relative proportions of annual production obtained by the three principal production methods.

and some production has also been obtained from Eocene sands.

However, the discovery of the Herrera sandstone at 4,700 ft. in Penal field in 1941 showed the possibilities of attractive reservoirs in the Oligocene, and wells capable of producing ultimates of 1,000,000 bbl. have been drilled to this sand. The ultimate recovery expected from the normal Miocene well is of the order of 60,000 to 200,000 bbl.

Trinidad new completions are dwarfed by those of the Middle East and Venezuelan Cretaceous fields. The current new successful completion in Trinidad may give an initial production from 50 to 350 bbl. per day, and the latter figure is the exception and is rarely exceeded. Reservoirs are generally of the undersaturated depletion type; wells show very rapid initial decline and must be controlled with small beans, usually ¼ to 6/32 in. in size, for most of the flowing life.

Geologic formations . . . From the standpoint of oil production, Trinidad is divided in half by the Central Range. No outcropping oil-bearing rocks occur to the north of this range, and several wells have been drilled without success. All the producing fields are found in the southern half of the island and all recent exploration drilling has been confined to this region.

With Venezuelan prolific Cretaceous limestone production as a prize dangling before geologists' eyes, exploration efforts have been directed since 1948 to the Cretaceous, known to contain prospective sands and argillites. These argillites and possibly limestones (which occur in thick masses in the Northern Range) could quite well provide fracture-type reservoirs with productive prospects comparable to those in Venezuela.

The discovery of deeper oil-bearing Oligocene Herrera sands at 8,000-10,000 ft. in Penal in 1946 gave encouragement to the exploration of similar concealed Oligocene structures which extend in southwest-northeast parallel trends across the southern half of the island.

The main targets of exploration drilling are therefore the Cretaceous and Oligocene.

Cretaceous exploration, however, has been singularly unsuccessful. Some 10 wells have already been drilled to this level finding only salt water or lack of fracturing in the argillite, but so far, however, without penetrating the equivalent limestones of western Venezuela.

Well histories . . . Trinidad Petroleum Development Co.'s Marabella well penetrated some 2,000 ft. of Cretaceous argillite, becoming more calcareous towards the base, but then passed through a thrust into Oligocene shale. A barefoot test of the argillite yielded only a little salt water.

Trinidad's deepest well, 34 Morne Diablo, was drilled to 14,018 ft. by Trinidad Leaseholds, Ltd., but failed to find production. Its Lizard Springs well was also a failure.

On the northern side of the Central Range, Trinidad Northern Areas, Ltd.'s, Mount Harris well was drilled

(Continued on page 344)

World Production Rises 4.8 Per Cent in 1952; Smallest Gain in 3 Years

Gain less than half that registered in 1951 and 1950. United States' increase only 1.9 per cent; now down to about half world total.

by Dahl M. Duff
International Editor

WORLD production of crude oil climbed by about 565,000 bbl. daily during 1952, but the percentage rate of increase was the smallest in the last 3 years.

During the year the world's oil fields produced at an average rate of approximately 12,339,000 bbl. daily. This represented a 4.8 per cent gain in contrast to increases of more than 12 per cent the two previous years.

The United States contributed 6,268,000 bbl. daily to total world output. The increase in domestic production over the previous year was only 1.9 per cent. On the other hand, non-Communist foreign areas showed a gain of 7.5 per cent to reach a total averaging 4,978,000 bbl. daily. If the estimated output of Russia and its satellites is included, total foreign production amounted to about 6,070,000 bbl. daily.

The slowdown in the rate of increase of world oil output during 1952 is attributed to a slackening in industrial activity abroad, more vigorous competition from other fuels, and to the fact that the extraordinary demands brought on by the Korean war have leveled off. The decline in industrial activity has lessened oil consumption in other important markets such as shipping.

Below are the percentage changes in crude-oil production by years:

Year	United States	Non-Communist foreign
1952	1.9	7.5
1951	13.8	11.9
1950	6.8	19.1
1949	—8.4	11.6
1948	8.5	22.5
1947	7.1	15.5

The ratio of United States production to total world output was again cut in 1952. The percentage represented by the United States dropped to 50.8 in contrast to 52.2 in 1951. In 1946 the figure was 63.1 per cent, and in 1939, 60.6 per cent. The share represented by the Middle East rose slightly during 1952 to reach 17 per cent of total world output.

The world's oil-producing column this year was marked by the almost complete disappearance of Iran. In 1951, full production was maintained in this country during the first half of the year when the British operators were in control of the properties. For the current year, Iranian output is believed to have averaged only about 25,000 bbl. daily, representing the amount produced and refined at Abadan and Kermanshah to meet domestic requirements. The figure is partly estimated; some informed sources in the industry believed actual Iranian output is even smaller.

Despite the fact that the industry was scrambling less than 1½ years ago to make up the sudden Iranian loss, current worries concern the possibility of too much crude oil. Since the war, nearly all foreign fields have been produced at virtually the limit of well potential or shipping facilities. This continues to be true in the smaller producing countries, but there is now between 400,000 and 500,000 bbl. daily of shut-in capacity in three major areas—Venezuela, Kuwait, and Saudi Arabia.

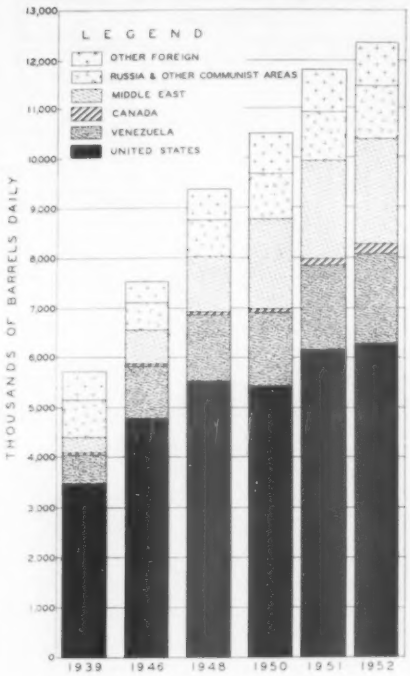
Several significant foreign production developments occurred during the year. Probably the most important was the new pipe-line outlet for Iraq which allowed this country to make the largest gain in production of any major oil area during 1952. In the Far East, the new Minas field went into commercial production. Canadian production scored a sharp gain and is due to chalk up another major increase next year.

Western Hemisphere . . . Production in Venezuela in 1952 averaged slightly above 1,800,000 bbl. daily. The increase of nearly 6 per cent compares with a gain of 13.8 per cent in 1951 and 13.3 per cent in 1950. Up to June, Venezuelan output was on the upgrade. Production was held at the maximum rate and in May a record was set with 1,844,400 bbl. daily. In succeeding months Venezuela's production dropped off slowly because of a decline in the heavy fuel-oil market partly caused by the steel strike in the United States and by seasonal factors.

Venezuelan officials earlier had anticipated that total production might average possibly 2,000,000 bbl. daily by the final month of the year. The country's oil production turned back up in October, and the decline again illustrated how sensitive Venezuela's basic industry is to conditions in its major markets, particularly the United States.

Five years of development work in

WORLD PRODUCTION BY AREAS



WORLD CRUDE-OIL PRODUCTION—(Thousands of Barrels Daily)

Country—	1952 partly est.	1951	Per cent change, 1952 vs. 1951	1950	1949	1948	1947	1946	1939	1928
Western Hemisphere:										
Argentina	68.5	66.0	3.8	64.0	61.9	64.8	59.9	56.4	51.1	24.9
Bolivia	1.5	1.4	7.1	1.6	1.9	1.3	1.3	1.0	0.6	
Brazil	2.0	1.9	5.3	0.8	0.3	0.4	0.3	0.2		
Canada	169.9	130.4	30.3	78.4	57.6	32.5	20.1	20.8	21.5	1.7
Chile	2.5	1.8	38.9	1.6	0.4					
Colombia	106.1	105.7	0.4	93.1	81.2	64.9	68.1	61.6	65.5	54.4
Cuba	0.1	0.2	—50.0	0.3	0.4	0.3	0.7	0.7	0.3	
Ecuador	7.7	7.6	1.3	7.4	7.2	7.0	6.6	6.4	6.3	3.0
Mexico	218.0	211.2	3.2	197.6	166.4	159.5	153.8	135.0	117.7	137.4
Peru	44.9	44.1	1.8	41.2	40.5	38.4	34.9	34.1	37.1	32.8
Trinidad	58.0	57.1	1.6	56.0	55.1	54.9	55.7	55.2	52.8	21.0
Venezuela	1,805.0	1,704.6	5.9	1,498.0	1,321.5	1,338.8	1,190.8	1,063.1	566.0	289.0
Total	2,484.2	2,332.0	6.5	2,040.0	1,794.4	1,762.8	1,592.2	1,434.5	918.9	564.2
Europe and Africa:										
France	7.1	5.4	31.4	2.4	1.1	1.1	1.0	1.1	1.4	1.4
French Morocco	2.6	1.5	73.4	0.8	0.3	0.2				
Western Germany	32.8	26.5	23.8	21.0	15.6	12.1	11.0	12.1	12.3	1.7
Italy	1.4	0.4	250.0	0.2	0.2	0.2	0.2	0.2	0.3	0.1
Netherlands	13.7	13.6	0.7	13.4	11.8	9.4	4.0	1.2		
Egypt	44.7	44.6	0.2	44.5	43.2	36.0	25.5	24.8	12.8	5.4
United Kingdom	1.1	0.9	22.2	0.9	0.9	0.9	1.0	1.1		
Total	103.4	92.9	11.3	83.2	73.1	59.9	42.7	40.5	26.8	8.6
Middle East:										
Bahrein	30.1	30.1		30.2	30.1	29.8	25.8	22.0	20.8	
Iran	26.0	350.4	—92.6	665.4	561.8	518.5	422.0	402.2	214.0	119.0
Iraq	380.6	176.3	116.0	136.2	86.3	72.2	99.2	97.8	84.3	2.0
Kuwait	750.0	561.4	33.6	355.0	247.0	127.2	44.5	16.2		
Qatar	68.4	48.8	40.2	34.1	2.0					
Saudi Arabia	840.0	761.5	10.3	546.7	476.7	390.3	246.2	164.0	10.8	
Turkey	0.4	0.3	33.3	0.3	0.3					
Total	2,095.5	1,928.8	8.6	1,767.9	1,404.2	1,138.0	837.7	702.2	329.9	121.0
Other Asia:										
British Borneo	105.0	102.7	2.2	84.8	69.2	55.0	36.1	5.5	19.5	14.3
Burma	2.3	2.0	15.0	1.0	0.5	0.5	0.6	1.9	21.6	24.0
India	5.6	5.3	5.6	5.0	5.3	5.3	5.1	6.0	6.4	(*)
Indonesia	168.0	151.7	10.8	141.0	115.8	86.8	22.0	5.8	170.5	88.0
Japan	5.9	6.4	—7.8	5.6	3.8	3.1	3.6	3.7	7.3	5.3
New Guinea	4.7	4.8	—2.1	4.8	4.7	0.4				
Pakistan	3.9	3.2	21.9	3.3	2.0	1.2	1.0	(*)	(*)	(*)
Total	295.4	276.1	7.0	245.5	201.3	152.3	68.4	22.9	225.3	131.6
Total foreign less Russia and other Communist areas	4,978.5	4,629.8	7.5	4,136.6	3,473.0	3,113.0	2,541.0	2,200.1	1,500.9	825.4
Estimated Russia and other Communist areas:										
Austria	47.0	42.0	11.9	34.0	20.0	17.0	15.9	15.7	3.4	
Romania	85.0	85.0		85.0	85.0	93.4	78.0	86.3	125.0	84.3
Russia	935.0	842.0	11.1	754.0	660.0	600.0	543.0	449.0	605.0	234.0
Other Com. areas†	25.2	24.9	1.2	25.3	23.0	17.0	18.2	22.3	16.6	15.3
Total	1,092.2	993.9	9.9	898.3	788.0	727.4	655.1	573.3	750.0	333.6
Total foreign	6,070.7	5,623.7	7.9	5,034.9	4,261.0	3,840.4	3,196.1	2,773.4	2,250.9	1,159.9
United States	6,268.0	6,149.4	1.9	5,402.3	5,046.4	5,519.6	5,087.6	4,750.5	3,465.6	2,463.0
Total World	12,338.7	11,773.1	4.8	10,437.2	9,307.4	9,360.0	8,283.7	7,523.9	5,716.5	3,622.0

*Pakistan included in India prior to 1947; both included under Burma for 1928. †Albania, China, Czechoslovakia, Hungary, Poland, and Yugoslavia.

Alberta has resulted in a more than eightfold increase in Canadian crude production. The fields on the prairie provinces are still dependent on local demand and the capacity of the single pipe line to the head of the Great Lakes. Completion of the new Trans-Mountain line to the Pacific Northwest along with other construction is expected to allow production to hit 300,000 bbl. daily or more some time in 1953. Exploratory work during the last year has given further evidence that Canada will become one of the world's leading oil-producing countries in a few more years.

Colombian production showed little change during 1952. Colombian output is largely limited by the capacity of the two major pipe lines carrying crude to the seacoast and world export markets. During the fall, production dropped back due to difficulties caused by heavy rains and to the necessity for pump repairs on one of the pipeline systems. Production in Mexico showed a minor increase. Several new areas were placed on production during the year but output in Poza Rica was held back in order to maintain the field's pressure.

Changes elsewhere in the Western Hemisphere were of little significance insofar as total world oil supplies were concerned. The small output in Chile rose sharply after the completion in June of a new gasoline and topping plant in the Tierra del Fuego producing region. The figure of 68,500 bbl. daily for Argentine production in 1952 is in line with industry estimates, though somewhat lower than indicated by data recently made public by the Argentine Government.

Middle East . . . The year 1952 was the first to reflect fully the results of the nationalization and the subsequent shutdown of the properties of Anglo-Iranian Oil Co., Ltd., in Iran. Increased production in the three other major countries—Saudi Arabia, Kuwait, and Iraq—offset the Iranian deficit and allowed an 8.6 per cent increase in over-all Middle East output.

The Iranian loss was less last year since the fields were on full production the first half. But since total Middle East output fell drastically the first few months after the shutdown, the 1951 increase for the entire region amounted to about 9 per cent. In 1950, Middle East production was up 25.9 per cent.

Of the several Middle East oil countries, Iraq is the most dependent on long-distance pipe lines because of the inland location of Kirkuk field. In the spring, Iraq Petroleum Co., Ltd., made the final weld in the new 30 and 32-in. line from Kirkuk to a new tanker terminal at Banias, Syria. The 32-in. sections are the world's largest in crude-oil service.

The full capacity of the line is in excess of 300,000 bbl. daily. Throughput was built up steadily through the year, and an additional approximately 160,000 bbl. daily continued to move to the Mediterranean from Kirkuk through the older 12 and 16-in. system to Tripoli, Lebanon. Total production from Kirkuk for the entire year amounted to some 1,500,000 long tons, or about 322,000 bbl. daily. Other Iraq production comes from Zubair field in the southern part of the country. This important area went on commercial production in December 1951 and had an output of about 2,200,000 tons, or around 44,600 bbl. daily during 1952. Remaining Iraq production comes from Khanaqin and from the northern Iraq concession of Mosul Petroleum Co., Ltd., which went into production the final quarter of the year.

The percentage gains in production of the other two leading Middle East oil countries both were less than in 1951. The 10.3 per cent increase for Saudi Arabian crude output compared with 39.3 per cent in 1951 and 14.9 per cent in 1950. Kuwait's production was up about 34 per cent in 1952 against a gain of more than 58 per cent last year.

Southeast Asia . . . Indonesia production in 1952 averaged around 168,000 bbl. daily, only slightly below the peak output of the immediate prewar years. The 1952 production, representing a gain of nearly 11 per cent over 1951, was augmented beginning in May when the new Minas field of the Caltex group went into commercial production in Central Sumatra. By October, production from this area has been brought to slightly more than 27,000 bbl. daily. Remaining Indonesian production is shared by the two older operators, Standard-Vacuum and Royal Dutch-Shell. Indonesia is the only large foreign producing area where output is not now considerably above the prewar total. Political and economic difficulties have hampered the industry in this country, and the increased demands of the Far East markets supplied from Indonesia have been met by shipments from the Persian Gulf.

Communist countries . . . According to Russian statements which are generally accepted, crude production in the Soviet Union is rising at a rate now close to 100,000 bbl. daily per year. The trend indicates that Russian output will top the million-barrel-daily mark some time in 1953. The official production goal is for 70,000,000 tons, or 1,385,000 bbl. daily, by 1955.

The oil output in the eastern European countries can only be guessed. Some reports now give an average exceeding 60,000 bbl. daily for Austria, but most industry estimates are somewhat lower. The Romanian industry was in a state of decline before the Communists took over in the country, and the figure of 85,000 bbl. daily for 1952 may be high. Leading producer among the remaining eastern European satellite countries is Hungary, and reports indicate that here too oil operations are hampered by difficulties of Communist management, equipment shortages, and other problems.

Western Europe . . . Italian oil production more than tripled during the current year. The country's total output is still minor, although considerable natural gas has been developed in the Po Valley fields. West German crude production this year reached another record and is now sufficient to meet roughly a third of the country's total petroleum requirements. In France, despite an intensive exploration program, no important fields have been found, and the 1952 increase in the country's small output reflects continued development of the Lacq area discovered in 1949.

Steel Bros. to Look for Oil

The British firm, Steel Bros. & Co., is again becoming active in the small-scale search for additional oil production in Great Britain.

Steel Bros. has taken two prospecting licenses from the Minister of Fuel and Power under the 1938 petroleum act. One is for 68 sq. miles and the other for 155 sq. miles, both in the county of Lancaster.

D'Arcy Exploration Co., Ltd. (Anglo-Iranian) is the only other active operator in Britain with a program that includes continued drilling in the Formby area, seismograph work east of Nottingham, and a wildcat on the Isle of Wight. Steel Bros. has previously been interested in British oil exploration.

Marine Filling Station in Rhine

A marine filling station has been opened at Cologne in West Germany to serve Rhine River traffic. The bunkering station, said to be the most modern on the river, is a project of the Esso A. G., and the Weber Schiff line. It handles diesel fuel and lubes, water, and a line of materials needed by ships.

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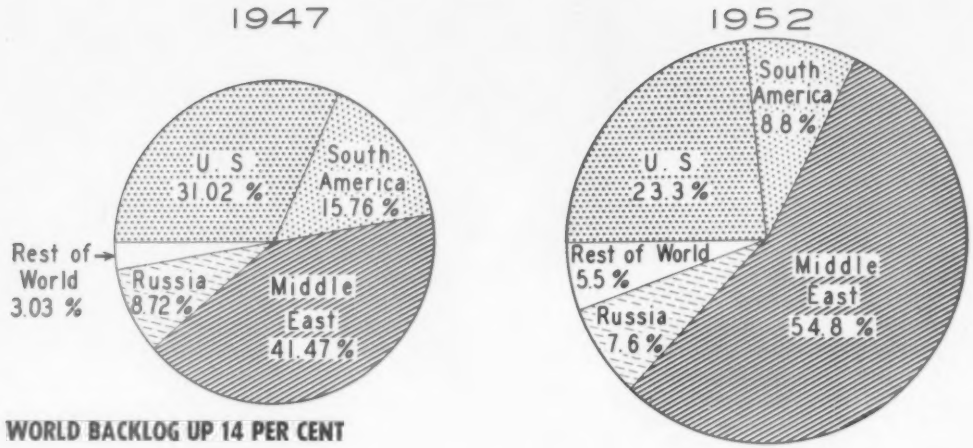

WORLD BACKLOG UP 14 PER CENT

Reserves Gain Largely From Persian Gulf Area

by Dahl M. Duff
International Editor

MOST of the increases estimated to have occurred in world reserves of crude oil in 1952 again were made in the prolific fields bordering the Persian Gulf.

Estimates of crude recoverable from these huge reservoirs have been revised upward during the year as a result of further drilling. The increases are due, not to major new field discoveries, but rather to extensions and widening of known producing areas, including particularly Burgan in Kuwait, Uthmaniyah-Ain Dar in Saudi Arabia, and Zubair in Iraq.

Total world reserves are now placed at some 118,151,000,000 bbl. This includes current estimates for all foreign areas plus United States reserves as of the beginning of the year. On the basis of 1952 production, the total represents slightly more than 26 years' supply.

Revised figures for reserves as of the end of 1951 show a total of approximately 103,632,000,000 bbl. The increase is more than 14,500,000,000 bbl., or 14 per cent. This percentage increase compares with an estimated gain of slightly less than 5 per cent in world production during 1952.

Excluding the United States, world reserves currently approximate in excess of 90,600,000,000. Total foreign reserves at the end of 1951 were about 77,500,000,000 bbl. The increase is around 13,103,000,000 bbl., or about 17 per cent.

The dominant position of the Middle East is shown in the fact that of the total increase in foreign reserve, some 11,300,000,000 bbl., or about 86 per cent, is credited to this region. Middle East reserves are estimated to make up 55 per cent of the world total, and, if the United States is excluded, nearly 72 per cent.

The accompanying tabulation is based on available published data on reserves by countries and also reflects opinions of various informed sources in the industry. The difficulty in obtaining precise or even reasonably approximate figures for many foreign areas is obvious. Besides the secrecy with which most companies treat their reserve position, estimates are made even less exact by the differing methods and procedures used by engineers and geologists in calculating reserves. Entering into this are such questions as how much area to attribute to field not completely defined, or to a promising area with only a few wells.

Various figures are announced from time to time by governments of some of the oil-producing countries. Even these must be treated with caution since they sometimes include acreage not fully proved by usual standards. The figures shown in the table for 1951 have been revised where appropriate from the data published in *The Oil and Gas Journal, December 20, 1951, page 224*. Some of these changes were indicated in an effort to place the estimates on a proved basis.

The rate at which reserves are being depleted in various oil-producing countries shows wide variation. Iran, with its largely shut-in industry producing only to meet local demand, takes No. 1 position in this respect. The entire Middle East has around 84 years' supply on the basis of 1952 production. This compares to 13.5 for South America, 15.2 in Europe, and 12.7 in North America. These rates depend on a variety of factors—state of development of the industry, quality of the crude oil, productivity of the fields, etc.

The total of 1,800,000,000 bbl. shown for Canada is lower than some recent estimates which range on up to 2,000,000,000 bbl. However, the figure given is believed to represent crude reserves as shown by development work to date. Undoubtedly Canadian reserves will make another sizable increase next year with continued work in existing fields in addition to likely new field discoveries.

The other important foreign reserve in North America is in Mexico. Mexican reserves have been augmented by the new field discovery of Tenixtepec or Ezequiel Ordonez, but this area is still in a preliminary state of development. The 1951 total represents the total given by the Mexican oil organization, Petroleos Mexicanos.

(Continued on page 184)

SLUSH-PUMP LINERS
from Bethlehem Pierced Forgings

Pump liners are one of the many types of parts that can be made easily from Bethlehem pierced forgings. If you are a builder of slush pumps, or if you sell finished liners to pump-builders, these forgings can save you important production time.

Note the collars on the samples shown here. Each pair is actually integral with the liner proper. The liners, including collars, are all single-piece forgings. When you receive these units, nothing remains to be done but finishing operations. No costly, time-wasting step of welding or shrinking collars into place. And there isn't the chance that a collar may loosen up or pull away.

Ask for further details of these seamless, one-piece liner forgings. We'll gladly co-operate in helping meet your present or future needs.

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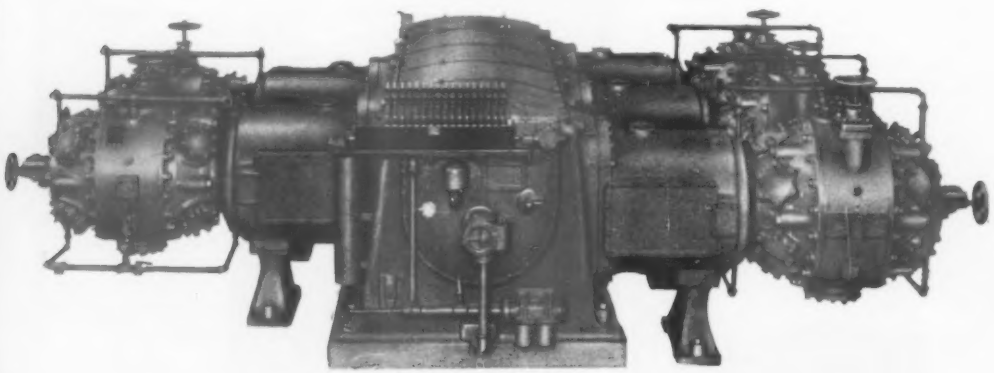
MODERN *Cooper-Bessemer* DESIGN HELPS MAINTAIN HIGH PRODUCTION . . . LOW COST OPERATION

Shown opposite are Cooper-Bessemer motor-driven compressors in two of the world's newest and largest synthetic ammonia plants.

The top view shows part of the 22,000 Cooper-Bessemer M-Line compressor horsepower installed in the ammonia synthesis plant of the Sindri Fertilizer Factory, Bihar Province, India. Here, ammonium sulphate can be produced at a rate of 1,000 tons a day — 350,000 tons a year!

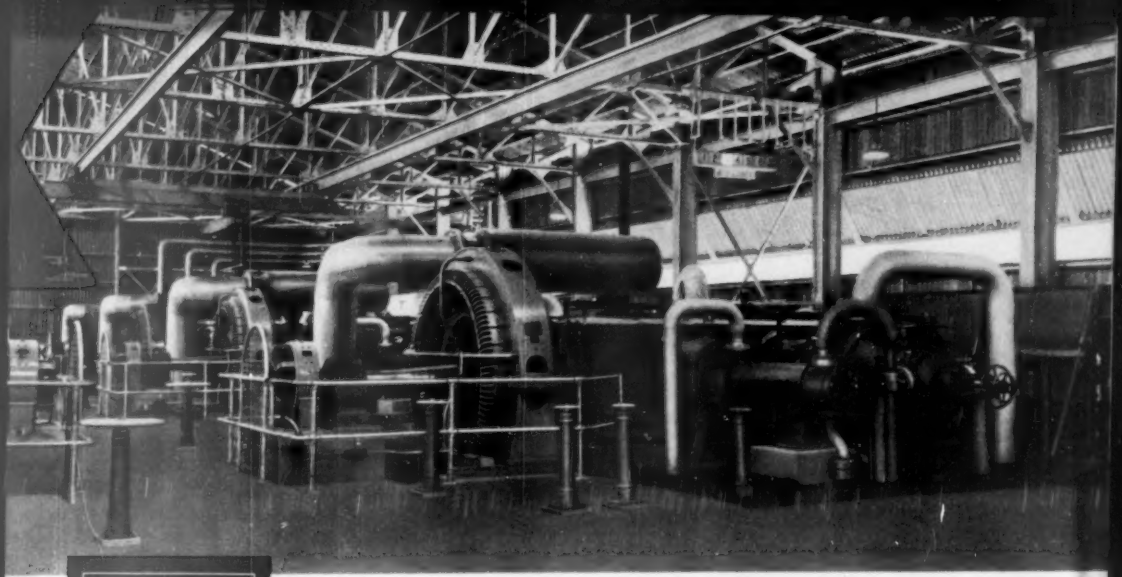
Similarly the other photo shows a line-up of Cooper-Bessemer compressors in the large Suez plant of the Societe Egyptienne D'Engrais et D'Industries (S.A.E.), Egypt. Here, calcium nitrate fertilizer is produced at a rate of 200,000 tons yearly.

In both plants, these modern Cooper-Bessemer units handle the entire compressing job and comprise the heart of production operations. For, with Cooper-Bessemers, you can be sure of year-in, year-out performance at the lowest operating cost.



COMPRESSORS-GAS ENGINES-DIESELS

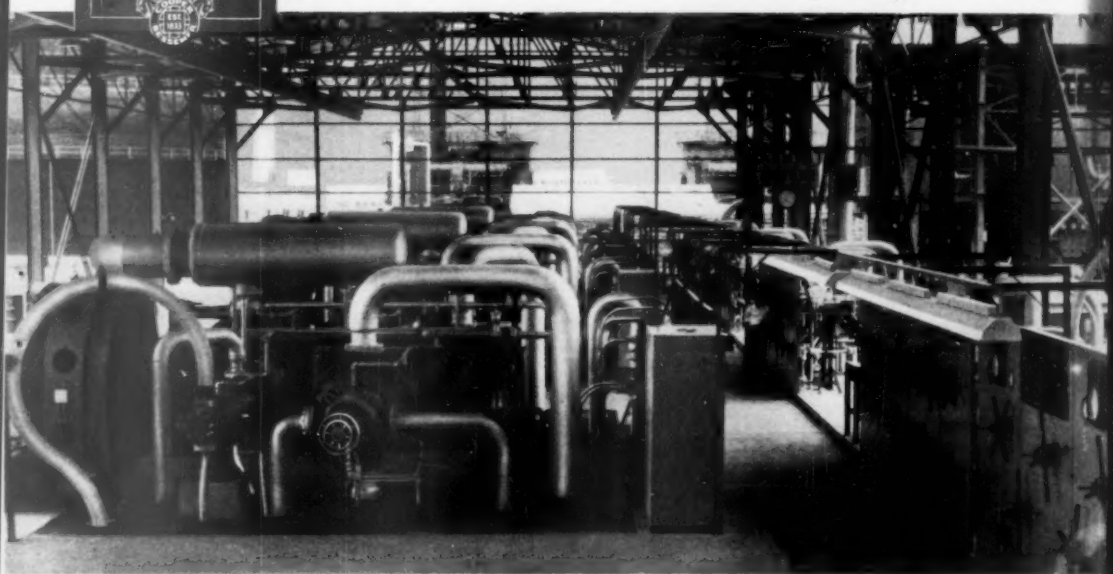
New York Washington, D. C. Bradford, Pa. Parkersburg, W. Va.
San Francisco, Cal. Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle, Wash.



Another Example of Efficient Power at Lower Cost

Cooper-Bessemer M-Line motor-driven compressor in the synthesis section of the Sindri Fertilizer Factory, India. Here eight 2,750 hp 7-cylinder units compress gas through six stages to a pressure of 5,500 psi. The huge Sindri plant was engineered by the Chemical Construction Corp., New York, and built under the direction and supervision of the Power-Gas Corp., Ltd., England.

Here, in the Suez plant of the Societe Egyptienne D'Engrais et D'Industries (S.A.E.), these four 2,750 hp JM-5 motor-driven units compress 25,344 mcf of gas daily from atmospheric to 5,200 psi for initial calcium nitrate production of 200,000 tons yearly. This plant, engineered by the Chemical Construction Corp., utilizes waste gases from nearby oil refineries.



by **Cooper-Bessemer**

MOUNT VERNON, OHIO AND GROVE CITY, PENNA.

Tulsa Shreveport St. Louis Los Angeles Chicago Caracas, Venezuela

WORLD CRUDE-OIL RESERVES

(Thousands of barrels)

Country—	1952 reserves 12-21-51*	1952 reserves Current	Annual production	Ratio, current reserves to '52 prod.
Canada	1,600,000	1,800,000	62,183	29.0
Cuba	3,850	3,500	37	94.5
Mexico	1,424,000	1,525,000	79,788	19.1
United States	26,121,000	†27,537,000	2,294,089	12.0
North America	29,148,850	30,865,500	2,436,097	12.7
Argentina	340,000	330,000	25,071	13.2
Bolivia	40,000	40,000	549	72.8
Brazil	35,000	45,000	732	61.5
Chile	35,000	45,000	915	49.2
Colombia	450,000	470,000	38,796	12.1
Ecuador	25,000	25,000	2,818	8.9
Peru	250,000	250,000	16,433	15.2
Trinidad	240,000	250,000	21,228	11.8
Venezuela	9,031,000	8,900,000	660,630	13.5
South America	10,446,000	10,355,000	767,172	13.5
France	25,000	30,000	2,599	11.6
W. Germany	185,000	200,000	12,005	16.7
Italy	2,500	5,000	512	9.8
Netherlands	75,000	75,000	5,014	15.0
United Kingdom	3,000	2,700	402	6.7
Europe	290,500	312,700	20,532	15.2
Egypt	170,000	155,000	16,360	9.5
French North Africa	5,000	8,000	952	8.4
Africa	175,000	163,000	17,312	9.4
Bahrein	300,000	290,000	11,017	26.3
Iran	15,000,000	15,000,000	9,516	1,580.0
Iraq	10,000,000	12,000,000	139,300	86.1
Kuwait	15,000,000	20,000,000	274,500	72.9
Qatar	1,200,000	1,500,000	25,034	60.0
Saudi Arabia	12,000,000	16,000,000	307,440	52.0
Turkey	20,000	35,000	146	239.7
Middle East	53,520,000	64,825,000	766,953	84.5
British Borneo	500,000	500,000	38,430	13.0
Burma	140,000	140,000	842	166.2
India	25,000	25,000	2,050	12.2
Indonesia	1,250,000	1,300,000	61,488	21.2
Japan	20,000	25,000	2,159	11.6
New Guinea	30,000	50,000	1,720	29.1
Pakistan	20,000	22,000	1,427	15.4
Far East	1,985,000	2,062,000	108,116	19.1
Austria	150,000	160,000	17,202	9.3
Romania	300,000	275,000	31,110	8.8
Russia	7,500,000	9,000,000	342,210	26.3
Other Communist-controlled areas‡	117,000	133,000	9,223	14.4
Russia & other Communist-controlled areas	8,067,000	9,568,000	399,745	23.9
World total	103,632,350	118,151,200	4,515,927	26.2

*Revised from figures published December 20, 1951, as indicated by subsequent information. †Estimate by The Oil and Gas Journal as of January 1, 1952. New United States reserves figures will be shown in the Journal's Annual Review and Forecast Issue, January 26. ‡Includes Hungary, Yugoslavia, China, Poland, Czechoslovakia, and Albania.

Of the total oil reserve of 10,355,000,000 bbl. in South America, about 86 per cent is accounted for by Venezuela. Venezuela's estimated 1951 reserves were officially announced by the Hydrocarbon Bureau of the Ministry in Caracas. It appears that the additional oil found in Venezuela during the past year fell slightly short of keeping pact with the heavy withdrawals from the country's existing fields. Some new oil has been blocked out in both eastern and western Venezuela, but it must be set against a production totaling more than 660,000,000 bbl.

Elsewhere in Latin America, the net changes in reserves do not appear to be of major significance. The smaller producing countries offset annual production or made small gains. Colombia is credited with a small increase, mainly on the basis of the Velasquez, Tetuan, and Totumal development.

The figures given for West German reserves are those reported as representing what has been proved. The country has another approximately 100,000,000 bbl. considered in the indicated or probable category. In the absence of further drilling as a result of the legal and political situation, Egypt's reserves have been depleted by virtually the full amount of production.

The total of reserves now credited to the Middle East is more than twice those in the United States. The reserves of the Middle East are concentrated in some 25 separate fields, of which four, Kirkuk in Iraq, Burgan in Kuwait, and Ain Dar-Uthmaniyah and Abqaiq in Saudi Arabia, contributed roughly 90 per cent of the region's total production. Kuwait's sharp increase in reserves is attributed to Burgan field as a result of last year's Magwa extension discovery.

Estimates of crude reserves in countries behind the Iron Curtain are, of course, largely guesses. The total given for Russia is somewhat lower than various other industry estimates which range on up to 15,000,000,000 bbl. The Russians themselves have laid claim to some 4,500,000,000 metric tons, or around 32,000,000,000 bbl., a figure not generally accepted as representing what has actually been proved by normal standards. Available information on conditions in the Romanian industry indicate a continued decline in the position of this once-important producing country. The increase given for other Communist countries represents in part Russian-transferred areas in Poland and minor gains credited to Yugoslavia, Albania, Czechoslovakia, and China.

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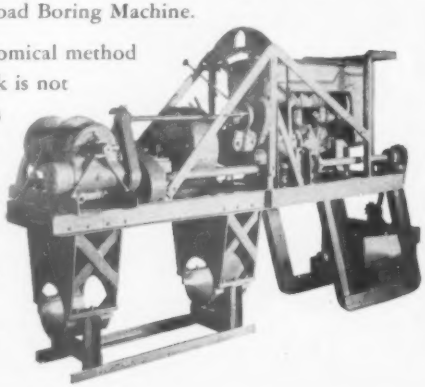

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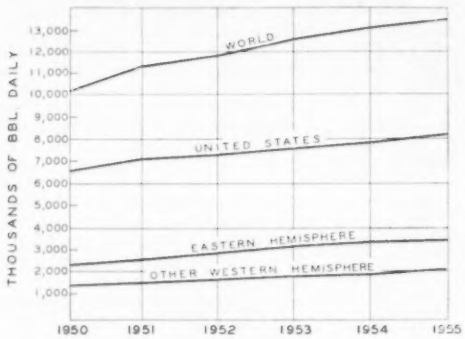
WORLD PETROLEUM DEMAND*



*Excluding Iron Curtain countries.

WORLD TRENDS*

WORLD DEMAND for petroleum in 1942 represented an increase of only 6 per cent over 1951 compared with a gain of 11 per cent in 1951.

WORLD DEMAND for 1955 is forecast at 13,603,000 bbl. daily or 35 per cent greater than for 1950.

FOREIGN DEMAND is expected to increase 8 per cent in 1953. Gain for United States is forecast at 5 per cent.

AVAILABILITY of crude and natural gas liquids will reach 15,326,000 bbl. daily by 1955 or 52 per cent greater than production in 1950.

FOREIGN REFINING capacity for 1954 is projected at 5,755,000 bbl. daily, up 37 per cent from 1950.

OVER 90 PER CENT of the world production of natural gas liquids is in the United States.

*Excluding Iron Curtain countries.

Free-World Demand Nears 12,000,000 Bbl. Daily

Average increase seen as 5 per cent annually

TOTAL petroleum demand of the free countries of the world will amount to about 11,800,000 bbl. per day for 1952, surpassing 1951 by 620,000 bbl. per day or 5.5 per cent. It is to be noted from Table 1 that during the 5 years from 1946 to 1951 inclusive, world demand for oil increased over 4 million barrels per day (57 per cent) or an average annual compound rate of about 10 per cent. Table 1 also indicates that beginning with 1952 there will be a period of several years of normal average yearly rate of growth of about 5 per cent.

Outlook for Demand in Foreign Countries

Total demand for crude and products for the free countries abroad averaged about 4,538,000 bbl. per day in 1952, an increase of 390,000 bbl. per day or 9.4 per cent above 1951. Table 3 portrays the fact that during the 5-year period 1946-1951, there was an increase in foreign demand of nearly 2 million barrels per day (89 per cent) of which over one-half occurred during 1950 and 1951, with yearly increases in excess of 15 per cent. For the 5-year period 1946-1951, there was an average annual growth rate of about 13 per cent. However, the foreign petroleum industry should be prepared to meet during each of the next 3 years substantial increases in demand for oil, averaging in excess of 300,000 bbl. per day or about 7 per cent.

Estimates of future local demand for petroleum products in countries abroad are based generally on a continuation of current trends. The projections assume no world-wide economic depression. For purposes of this forecast, it is assumed that the Abadan refinery will resume operation some time in 1953, running about 50 per cent of capacity next year and near 100 per cent during 1954 and 1955.

Table 4 sets forth the world demand by broad geographical areas. Available reports indicate an increase for 1952 in each area with the exception of the Middle East where demand fell off due to nonoperations (normal rate) of the

TABLE 1—WORLD DEMAND — CRUDE AND PRODUCTS (EXCLUDING IRON CURTAIN COUNTRIES)
(Thousands of barrels daily)

Year—	Demand	Increase— Volume	Per cent
Actual:			
1946	7,110		
1947	8,012	902	12.7
1948	8,600	588	7.3
1949	8,881	281	3.3
1950	10,099	1,218	13.7
1951	11,180	1,081	10.7
*1952	11,800	620	5.5
Outlook:			
1953	12,527	727	6.2
1954	13,098	571	4.6
1955	13,603	505	3.9

*Partly estimated.

TABLE 3—FOREIGN DEMAND—CRUDE AND PRODUCTS (EXCLUDING IRON CURTAIN COUNTRIES)
(Thousands of barrels daily)

Year—	Demand	Increase— Volume	Per cent
Actual:			
1946	2,198		
1947	2,560	362	16.5
1948	2,825	265	10.4
1949	3,078	253	9.0
1950	3,592	514	16.7
1951	4,148	556	15.4
*1952	4,538	390	9.4
Outlook:			
1953	4,902	364	8.0
1954	5,213	311	6.3
1955	5,483	270	5.2

*Partly estimated.

TABLE 2—DEMAND BY PRODUCTS
(Thousands of barrels daily)

	Actual 1951 U. S. domestic	Foreign local*†	World*	Outlook for 1955 U. S. domestic	Foreign local*	World*
Gasoline (incl. avgas)	2,981	1,087	4,068	3,500	1,444	4,944
Middle distillate	1,563	988	2,551	1,910	1,367	3,277
Residual fuel oil	1,545	1,700	3,245	1,580	2,180	3,760
Lubricants	116	87	203	119	106	225
Other products	804	253	1,057	987	343	1,330
Total products	7,009	4,115	11,124	8,096	5,440	13,536
Crude as such and loss	23	33	56	24	43	67
Total demand	7,032	4,148	11,183	8,120	5,483	13,603

*Excluding Iron Curtain countries. †Foreign local demand by products partly estimated.

TABLE 4—WORLD PETROLEUM DEMAND BY AREAS (EXCLUDING IRON CURTAIN COUNTRIES)
(Thousands of barrels daily)

	Actual		Outlook		
Local demand by areas—	1951	1952	1953	1954	1955
United States	7,032	7,262	7,625	7,885	8,120
Other North America	751	801	860	912	965
Caribbean	367	450	469	502	524
Other South America	389	435	473	515	551
Total Western Hemisphere:					
Excluding United States	1,507	1,686	1,802	1,929	2,040
Including United States	8,539	8,948	9,427	9,814	10,160
Western Europe	1,438	1,605	1,753	1,854	1,945
Other E. Hemisphere—west of Suez	321	341	366	386	405
Total E. Hemisphere—west of Suez	1,759	1,946	2,119	2,240	2,350
Middle East	303	265	288	309	313
Far East, S. and E. Africa and Oceania	579	641	693	735	780
Total E. Hemisphere east of Suez	882	906	981	1,044	1,093
Total Eastern Hemisphere	2,641	2,852	3,100	3,284	3,443
Total foreign	4,148	4,538	4,902	5,213	5,483
Total world	11,180	11,800	12,527	13,098	13,603

Abadan refinery which caused a decline in bunker-oil deliveries to ocean vessels and refinery fuel consumption.

Foreign demand for each refined product group has been placed in Table 2 alongside similar data for United States in order to facilitate comparisons. It is to be noted that for 1951 the United States domestic demand for gasoline was 42 per cent of the total of all products as compared to only 26 per cent for foreign countries; also that residual fuel oil represented only 22 per cent of the total United States demand as against 41 per cent abroad.

Outlook for World Supply

Total production of crude oil and allied products for the free countries of the world reached this year a level of about 11,949,000 bbl. per day, a gain of 532,000 bbl. per day or 4.7 per cent over 1951. Following the slowing down this year in the rate of growth in world demand, the gain in production for 1952 versus 1951 is less than that for 1950 and 1951 according to the data given in Table 5.

The upward trend in availability of world supply during the next 3 years runs nearly parallel with world demand as reflected in the increases as set forth in Tables 1 and 6.

Table 7 shows refining capacity by geographical areas. During 1952 the largest growth both actual volume and percentagewise occurred in western Europe. During 1953 and 1954 substantial additional refining capacity is indicated for the United States with continued growth in Europe and in other areas of the world. Notwithstanding the expected large growth in crude-distilling capacity, foreign refineries must continue generally to run at high operating rates in the event that the Abadan plant remains inoperative. Since the closing down of the world's largest oil refinery in June 1951, an additional load has been placed upon plants located in the free countries of Europe, the Caribbean area, and also to some extent in the United States.

To meet part of the loss of supplies due to the cessation of operations at Abadan, a number of refineries in other parts of the Eastern Hemisphere stepped up crude runs to rates in excess of designed capacity. Also to overcome the critical shortage of residual fuel oil most refineries generally maximized the output of that product. World demand for residual fuel oil during the past year fell below expectations due to a number of factors among them the following:

The winter of 1950-51 was milder than usual in Europe—coal production abroad has been higher than expected —decline in world ocean vessel bunker fuel oil demand due to a falling off generally in international shipping trade —a return of many United States merchant vessels to the reserve fleet—and the leveling off generally of industrial activity and commercial trade in many countries abroad.

Therefore some of the foreign refineries are currently confronted with the problem of balancing output of each refined product from present facilities with demand for each product.

TABLE 5—WORLD SUPPLY—CRUDE AND ALLIED PRODUCTS (EXCL. IRON CURTAIN COUNTRIES)

Year—	Production	Increase volume
Actual:		
1946	7,317	
1947	8,033	716
1948	9,069	1,036
1949	8,992	—77
1950	10,101	1,109
1951	11,417	1,316
1952	11,949	532

	Availability		Increase	
	Incl. Iran	Excl. Iran	Incl. Iran	Excl. Iran
Outlook:				
1953	14,203	13,503		
1954	14,871	14,171	668	668
1955	15,326	14,626	455	455

TABLE 6—WORLD SUPPLY NATURAL-GAS LIQUIDS
(Thousands of barrels daily)

Year—	U. S.	Foreign	Total
Actual:			
1950	499	46	545
1951	564	55	619
1952	600	60	660
Outlook:			
1953	650	64	714
1954	690	68	758
1955	730	72	802

TABLE 7—WORLD REFINING CAPACITY (EXCL. IRON CURTAIN COUNTRIES)
(Thousands of barrels daily)

	Actual refining capacity*		Outlook for refining capacity*	
	1951	1952	1953	1954
United States	7,100	7,333	7,911	8,388
Other North America	592	652	685	716
Caribbean	1,341	1,356	1,420	1,429
Other South America	221	258	262	320
Total Western Hemisphere:				
Excluding United States	2,154	2,266	2,367	2,465
Including United States	9,254	9,599	10,278	10,853
Western Europe	1,208	1,477	1,649	1,755
Other Eastern Hemisphere—west of Suez	177	183	201	201
Total Eastern Hemisphere—west of Suez	1,385	1,660	1,850	1,956
Middle East†	902	933	933	933
Far East, South and East Africa and Oceania	303	352	365	401
Total east of Suez	1,205	1,285	1,298	1,334
Total Eastern Hemisphere	2,590	2,945	3,148	3,290
Total foreign	4,744	5,211	5,515	5,755
Total world	11,844	12,544	13,426	14,143

*Yearly average. †Abadan refinery included at 525,000 bbl. per day.

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Tanker Tonnage Keeps Pace With Soaring World Demand for Petroleum Products

Tanker employment continues to expand despite major pipe-line construction. Today's world fleet comprises 2,084 tankers, totaling 30,809,024 d.w. tons

by John J. Winterbottom

THE increase in world-wide demand for petroleum products since the close of World War II has fostered a similar growth in the world tanker fleet, not only in total tonnage afloat but also in size of tankers. Prior to World War II, as of September 1, 1939, the world fleet of tankers 6,000 d.w. tons and over, including military and special service ships, totaled 1,288 vessels, aggregating 14,738,464 d.w. tons.

After the war, as of January 1, 1947, this fleet had increased to 1,701 vessels of 22,955,015 d.w. tons. Since then, construction of new tanker tonnage has continued at a rapid rate; as of October 1, 1952, there were 2,084 tankers totaling 30,809,024 d.w. tons, equivalent to 1,710 T-2 type tankers. The T-2 tanker, of 16,600 d.w. tons, 14.5-knot speed, was built in great numbers during World War II in United States shipyards.

Under construction . . . Tankers under construction or on order in shipyards throughout the world as of October 1, 1952, amounted to 745 vessels, aggregating 15,616,230 d.w. tons equivalent to 980 T-2's. Table 1 indicates distribution of the new construction by country of builders' yards and by contract delivery dates, as they are known. With the exception of a brief period during 1949 when a considerable amount of tanker tonnage was placed in tieup due to lack of business, and a number of old obsolete vessels were scrapped, the delivery of new tanker tonnage from shipyards has been absorbed in the world petroleum trade.

Of the total world fleet as of October 1, 1952, 8,368,506 d.w. tons or 27 per cent was registered under the United States flag, the largest single group by country of registry, with the remainder distributed under flags of 32 nations as listed in Table 2. However, only 5 per cent of the new construction on order as of that date is destined for United States registry.

Service record . . . Excluding government-owned vessels, tankers in special service (such as whaling, molasses carriage, etc.) and vessels out of service for repair for periods in excess of 30 days, the world-wide requirement for tankers in 1948 engaged the continuous use of the equivalent of 909 T-2 type tankers, increasing to 955 in 1949, 1,121 in 1950, and 1,249 in 1951.

In 1952, it is expected to average approximately 1,350 T-2 equivalents, an increase of 49 per cent in 4 years. Table 3 details the area of employment of tonnage during the years 1948 through 1951 and the first half of 1952. It reveals that the increase in foreign-flag tonnage and in tankers engaged in service to foreign destinations is greatly in excess of the United States flag, United States destination tanker use.

The extensive expansion of tanker employment has occurred despite major pipe-line construction which has had the effect of reducing the number of tankers required by shortening the distance between crude sources and refineries. For example, the 30-31-in. Trans-Arabian pipe line from the Persian Gulf to Sidon, Lebanon, now operates at 310,000 bbl. per day throughput. This 1,068-mile-long line has shortened the tanker haul to destinations west of Suez by 3,000 miles and has reduced the world-wide tanker need by 75 T-2 equivalents. The new Iraq Petroleum Co. 30-32-in. line from Iraq oil fields to Banias, Syria, which is expected to reach a capacity of 371,000 bbl. per day in 1954, will effect a saving of 90 T-2's compared with tankers hauling a similar crude volume from the Persian Gulf.

Tanker tonnage . . . As in other phases of the petroleum industry, there is con-

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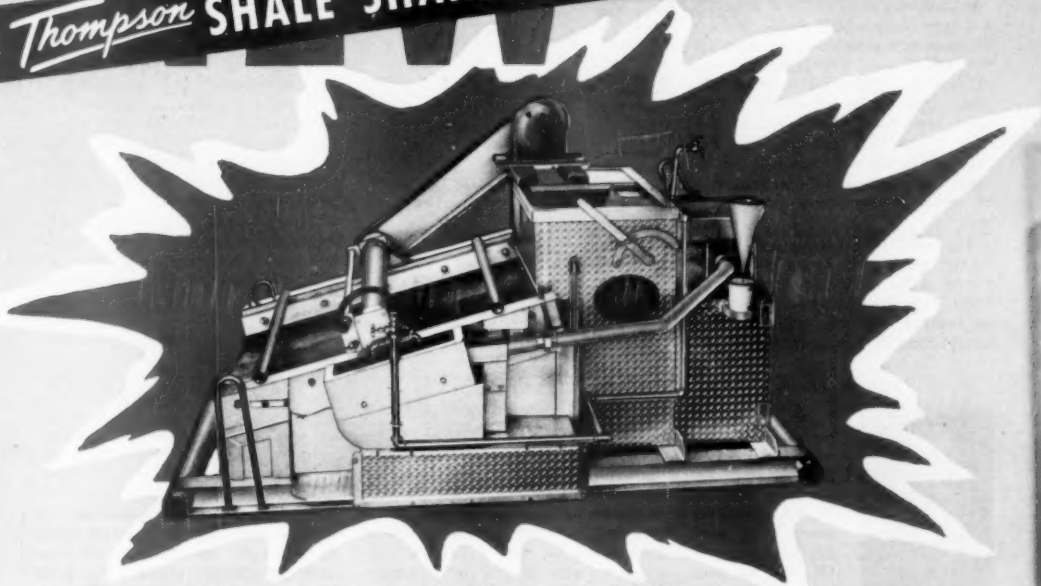

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stant research to determine the future tanker-tonnage outlook. Adequacy of tankers in numbers, size and type of ship design, and other factors which influence transportation economy and policy are subject to continuous review. In 1939, the average tanker in operation was of 11,600 d.w. tons. The T-2 type tankers built during the war, which in part replaced many older vessels which were war casualties, were an important influence in larger ship design, and by mid-1946 the average world tanker had increased 2,000 d.w. tons in size. The present world fleet averages 14,500 d.w. tons and the 745 vessels presently under construction or on order average about 21,000 d.w. tons.

The trend toward larger units in new tanker construction during the postwar period is the inevitable result of the lower transportation costs which can be realized. This has resulted in the construction of a considerable number of tankers in the range of 26,000 d.w. tons and there are numerous 30,000-d.w.-ton vessels presently under construction with several in operation. Going beyond this, there are tankers up to 45,000 d.w. tons under construction and it is foreseeable that even larger ships may be built in the near future.

Major considerations in the extensive operation of large ships are: (1) the limitations imposed at loading and discharging terminals by the depth of water and other physical restrictions; (2) the corresponding increases in capital investment for shore tankage and other terminal facilities. Although this problem is being met by improvements at many ports, there are undoubtedly many trades where the restricted volume of petroleum movements and permanent physical restrictions will require the continued use of moderate-sized tankers.

It is of primary interest to analyze the future tanker position from the

THE AUTHOR

John J. Winterbottom is coordinator of transportation activities for Standard Oil Co. (N. J.), having assumed that position on January 1, 1952. He has been employed by Jersey Standard since 1916, and during that time has served as executive vice president of Esso Shipping Co. and assistant general manager of the Jersey Marine Department. In 1944 he served on loan to the War Shipping Administration in Washington as director of tankers.

TABLE 2—REGISTRY OF TANKERS 6,000 D.W. TONS AND OVER AS OF OCTOBER 1, 1952

Country—	No. of vessels	D.w. tons	T-2 equiv.
Great Britain	469	6,308,207	323.0
Canada	14	224,110	13.3
Norway	310	4,706,252	252.6
Italy	88	1,110,002	58.2
France	80	1,231,278	66.4
Venezuela	3	28,714	1.2
Netherlands	62	717,811	36.5
Panama	178	2,874,777	165.2
Germany	13	170,501	7.7
Argentina	32	412,219	22.6
Mexico	16	169,439	7.6
Greece	12	160,606	8.7
Brazil	12	177,877	10.2
Spain	19	177,485	8.7
Russia	19	188,769	8.4
Denmark	31	462,060	25.0
Honduras	11	220,613	13.3
Portugal	6	84,682	4.6
Turkey	2	30,268	1.6
Belgium	8	100,456	5.1
Sweden	59	881,969	49.9
Finland	7	78,520	3.4
Yugoslavia	2	21,710	1.0
Uruguay	2	33,224	2.1
China	5	59,700	2.5
Poland	2	21,369	.9
Switzerland	2	22,360	1.0
Morocco	1	15,420	.7
Japan	35	572,050	30.9
Liberia	57	1,157,983	70.7
Pakistan	1	9,760	.4
Costa Rica	1	10,327	.4
United States	525	8,368,506	505.7
Total	2,084	30,809,024	1,709.5

TABLE 1—TANKERS 6,000 D.W. TONS AND OVER REPORTED UNDER CONSTRUCTION OR ON ORDER AS OF OCTOBER 1, 1952

				Estimated delivery dates—T-2 equivalent								
Yards—	No.	D.w. tons	T-2 equiv.	Bal. 1952	1953	1954	1955	1956	1957	1958	1959	Unknown
United States	58	1,606,645	106.9	5.7	50.4	43.9	6.9					
British	284	5,691,235	354.7	40.1	83.8	69.8	50.7	31.8	16.0	4.6		57.9
Canadian	5	103,400	6.4	1.9	4.5							
Swedish	117	2,334,500	145.5	17.2	34.4	34.5	24.4	21.7	2.1			11.2
Norwegian	41	740,000	46.0	1.0	6.6	5.9	9.6	8.8	7.7	.4	2.0	4.0
Danish	20	342,400	21.3	1.9	2.1	4.1	2.3					10.9
French	26	658,950	41.0		9.5	3.7	3.2					24.6
Spanish	9	142,300	8.9			4.6						4.3
Netherlands	59	1,189,450	74.2	7.7	14.0	14.2	15.6	5.4				17.3
Italian	16	343,000	21.4	1.1	13.2	3.2						3.9
Belgian	13	240,150	14.9	2.1	6.1	4.5						2.2
Japanese	30	737,700	46.0	3.6	28.7							13.7
German	67	1,486,500	92.6	8.7	23.8	21.3	8.4	2.0				29.4
Total	745	15,616,230	979.8	91.0	277.1	209.7	121.1	69.7	25.8	5.0	2.0	178.4

ACTUAL TANKER DELIVERIES

	Jan.-Sept. 1952			1951			1950		
	No.	D.w. tons	T-2 equiv.	No.	D.w. tons	T-2 equiv.	No.	D.w. tons	T-2 equiv.
United States yards	6	146,500	9.4	4	120,000	8.0	23	600,450	38.2
Foreign yards	87	1,616,911	97.1	128	2,116,715	123.1	103	1,561,216	88.6
Total	93	1,763,411	106.5	132	2,236,715	131.1	126	2,161,666	126.8

standpoint of the adequacy of tanker tonnage. Many major oil companies own tanker fleets but still depend to a large extent on shortage and long-term charters as well as single-voyage charters to fill out their tonnage needs. To meet these demands, a large block of world tanker tonnage, owned by independent operators, is submitted for charter on the open market.

Tanker charter rates are influenced by the supply of and demand for tonnage and fluctuate sharply when these factors are in imbalance. There are few commodities for which the price is as sensitive to supply and demand as tanker tonnage. Normally, the heavy demand for tankers in the United States East Coast heating-oil trade has forced rates upward in the winter periods and conversely, rates have reacted from this position during the summer.

Future requirements . . . In estimating future requirements the period of peak requirements each year is considered more indicative of the tanker picture than average year requirements. Peak requirements, usually occurring at the end of each year, have ranged between 3 and 8 per cent in excess of average requirements during the last 4 years. It is estimated that the year-end peak requirements for 1952 will approximate the equivalent of 1,453 T-2 type tankers. Estimated tonnage availability, including allowances for normal repairs, new construction, and obsolescence, amounts to 1,516 T-2 equivalents.

Table 4 outlines an estimates of the world-wide industry tanker tonnage situation as of the end of each year through 1956. Requirements are estimated to increase 25 per cent from the 1952 peak to 1,815 T-2's by the end of 1956. Included is an allowance for the use of commercial tankers in U. S. Government service. These requirements assume operation of the Tapline at 310,000 bbl. per day, the I.P.C. line to Banias at 300,000 bbl. per day in 1952, increasing to 340,000 in 1953 and 371,000 in 1954, and the I.P.C. lines to Tripoli at 162,000 bbl. per day. The I.P.C. lines to Haifa are assumed to remain inoperative during the period.

The effect of Trans-Mountain pipe line, which is scheduled to begin operations during 1953, is included in the requirements. This line will bring crude from the Edmonton fields of Canada to British Columbia and will reserve the present flow of petroleum from California to Vancouver. A portion of the Middle East crude presently being transported to California will be replaced by Alberta crude through Trans-Mountain. For the purpose of estimating requirements it has been arbitrarily assumed that Abadan refinery operations will resume in 1954. However the difficulties imposed by the change in world-trade routes and supply sources occasioned by this shutdown have been largely overcome and the effect on tanker requirements would be relatively minor should this refinery remain closed.

Tonnage availability estimates pre-

TABLE 3—INDUSTRY TANKER EMPLOYMENT (EXPRESSED IN EQUIVALENT T-2 TYPE TANKERS)

	World wide			U. S. destination			Foreign destination		
	Total	U. S. flag	Foreign flag	Total	Ex. W. Hem.	Ex. E. Hem.	Total	Ex. W. Hem.	Ex. E. Hem.
1948	909	375	534	337	300	37	572	567	305
1949	955	352	603	341	290	51	614	229	385
1950	1,121	372	749	402	340	62	719	223	496
1951	1,249	385	864	375	333	42	874	319	555
First half 1952	1,315	383	932	401	350	51	914	352	562

Excludes government-owned tankers, vessels in special service (whaling, molasses carriage, etc.) and vessels out of service for repairs for periods in excess of 30 days.

TABLE 4—ESTIMATED TANKER REQUIREMENTS AND TONNAGE—WORLD-WIDE INDUSTRY—EQUIVALENT T-2 TANKERS

	1952	1953	1954	1955	1956
Available year-end tonnage, reflecting new construction and obsolescence*	1,516	1,686	1,856	1,996	2,136
Peak requirements	1,453	1,547	1,603	1,703	1,815
Surplus	63	139	253	293	321

*Includes allowances for repairs, new construction and obsolescence

TABLE 5—WORLD'S TANKER TONNAGE—CLASSIFIED BY AGES (TANKERS 6,000 D.W. TONS AND OVER) AS OF OCTOBER 1, 1952

Year built	United States		Foreign		Total	
	No.	D.w. tons	No.	D.w. tons	No.	D.w. tons
1952	3	62,328	92	1,752,508	95	1,814,836
1951	2	60,310	129	2,187,183	131	2,247,493
1950	4	110,505	123	2,105,547	127	2,216,052
1949	3	80,102	96	1,710,865	99	1,790,967
1948	1	18,151	48	686,477	49	704,628
1947	1	12,853	30	411,059	31	423,912
1946	7	115,520	48	562,337	55	677,857
1945	86	1,455,269	125	1,946,529	211	3,401,798
1944	131	2,173,670	136	2,091,351	267	4,265,021
1943	148	2,256,874	86	1,234,965	234	3,491,839
1942	45	722,167	43	585,459	88	1,307,626
1941	18	270,095	29	382,164	47	652,259
1940	11	174,779	14	212,223	25	387,002
1939	6	101,645	48	631,538	54	733,183
1938	8	112,602	33	427,505	41	540,107
1937	13	163,567	40	539,816	53	703,383
1936	6	83,660	31	377,994	37	461,654
1935	2	29,760	27	337,040	29	366,800
1934			9	95,507	9	95,507
1933			7	113,815	7	113,815
1932			17	190,695	17	190,695
1931	3	44,650	45	545,770	48	590,420
1930	5	65,676	44	564,405	49	630,081
1929			27	318,652	27	318,652
1928	5	70,046	35	400,704	40	470,750
1927	2	34,660	29	294,155	31	328,815
1926	1	14,875	9	92,621	10	107,496
1925			5	53,888	5	53,888
1924	1	10,457	6	57,697	7	68,154
1923			11	108,218	11	108,218
1922			16	168,882	16	168,882
1921	5	54,455	29	334,190	34	388,645
1920	3	29,830	25	246,903	28	276,733
1919	1	7,920	12	127,025	13	134,945
1918	1	8,500	12	116,602	13	125,102
1917	1	11,200	4	38,080	5	49,280
1916			9	82,659	9	82,659
1914			11	128,421	11	128,421
1913			10	99,906	10	99,906
1912	1	6,150	2	17,780	3	23,930
1910			1	8,075	1	8,075
1908			1	7,065	1	7,065
1905			1	12,749	1	12,749
1903			1	6,775	1	6,775
1902	1	6,230			1	6,230
Prior to 1902			3	26,719	3	26,719
Total	525	8,368,506	1,559	22,440,518	2,084	30,809,024

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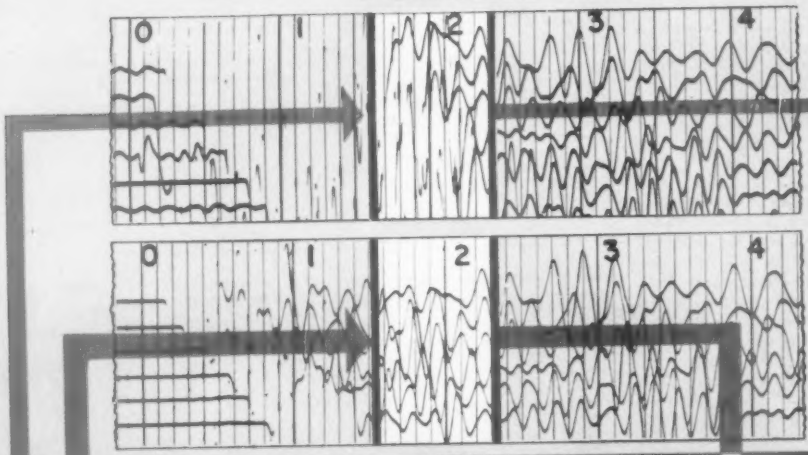
The Effect of AUTOMATIC VOLUME CONTROL (AVC)



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sented here are based on the actual world-wide tanker fleet engaged in petroleum services as at the peak of 1951, including vessels out of service for normal repairs, plus new construction and an allowance for obsolescence. The allowances made for new construction and obsolescence are as follows:

	T-2 equivalents
Tanker fleet as of end 1951	1,371
Estimated 1952 new construction	150
Estimated 1952 obsolescence	(5)
End 1952	1,516
Estimated 1953 new construction	175
Estimated 1953 obsolescence	(5)
End 1953	1,686
Estimated 1954 new construction	175
Estimated 1954 obsolescence	(5)
End 1954	1,856
Estimated 1955 new construction	160
Estimated 1955 obsolescence	(20)
End 1955	1,996
Estimated 1956 new construction	160
Estimated 1956 obsolescence	(20)
End 1956	2,136

New construction estimates shown above are based on contract delivery dates from United States yards as of the early part of 1952 and assumed deliveries of 125 T-2's from foreign yards in 1952 and 140 each year in the period 1954-1956. If contract dates were used for deliveries from foreign yards, the projected new construction figures would be higher as indicated in Table 1. However, if there is a certain amount of optimism in the contract dates, actual deliveries may be more in line with the above estimates.

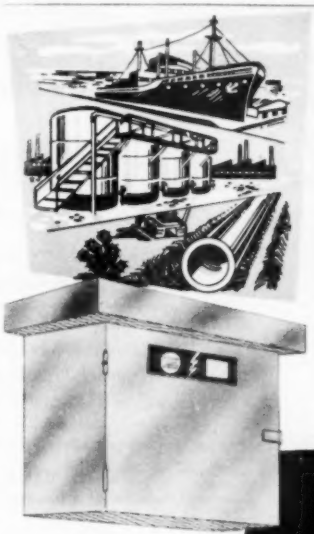
Compared with estimated 1952 deliveries of 150 T-2 equivalents, 107 were delivered during the first 9 months of the year. Although the allowance for obsolescence appears conservative, the high level of tanker freight rates which has prevailed over the last several years has enabled owners to maintain older high-cost vessels in service. Undoubtedly, prior to a tanker surplus of the magnitude indicated in Table 4, freight rates will decrease as tonnage comes into balance with demand and a number of the older high-cost ships will be withdrawn from service as they become uneconomical to operate at prevailing charter rates.

It is for this reason that the tanker surpluses shown in Table 4, ranging from 63 T-2's in 1952 to 321 in 1956, cannot be considered as a forecast of the actual number of ships which will be surplus to needs. As indicated in Table 5, there are presently 395 vessels (equivalent to 192 T-2's) in the tanker fleet 20 years or older, of which 214 vessels (equivalent to 93 T-2's) are 25 years or older. As tankers attain a balance with demand, it is expected that the major portion of ships which will be withdrawn from service for economic reasons will come from this group.

Looking beyond 1956, the present United States flag commercial fleet of 428 tankers (equivalent to 397 T-2's) include 228 T-2 type tankers built during World War II. The total war-built tankers presently in the United States commercial tanker fleet is equivalent to 315 T-2's or 79 per cent. Assuming an average life of 20 years, these tankers will become obsolete during the early 1960's. There are presently the equivalent of 107 T-2's under construction or on order in United States yards of which only 53 are destined for registry under United States flag.

Isle of Wight Wildcat

A wildcat test was begun recently by D'Arcy Exploration Co., Ltd. (Anglo-Iranian) near Arreton on the Isle of Wight. The well is to be taken to 8,000 ft. if necessary. The location followed gravity and reflection seismograph work.



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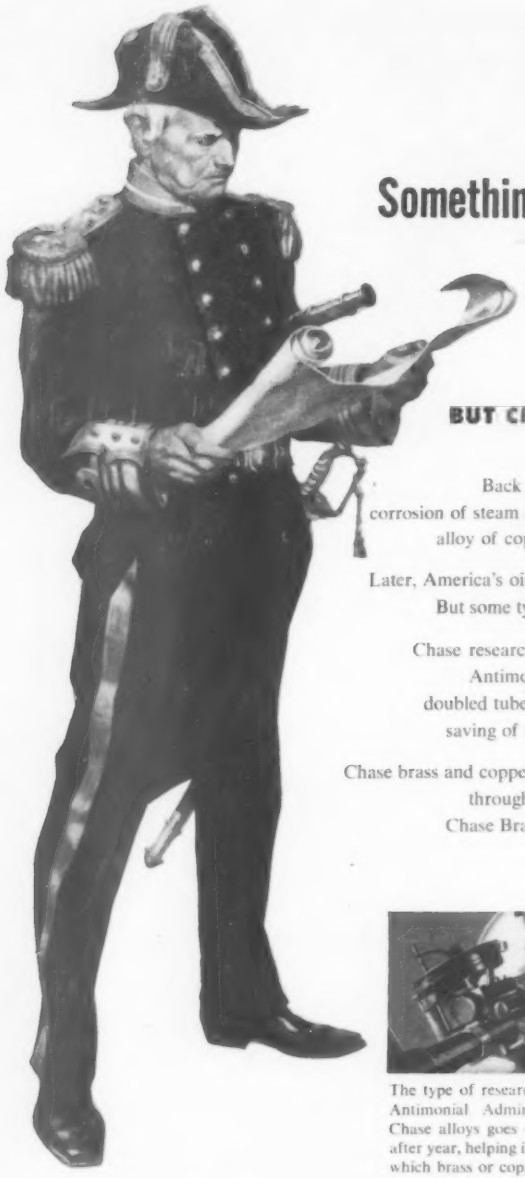

Something the Admiral didn't know

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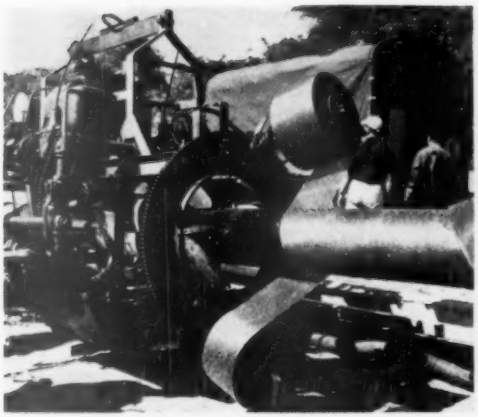
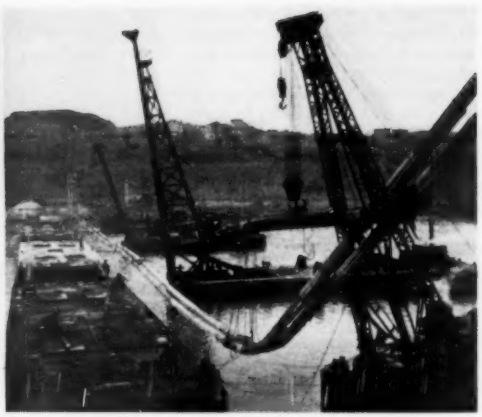


View of the coating machine



Crossing the Seine in Paris outskirts.

by J. B. Capdeville*

New French Le Havre-Paris Products Line Completed

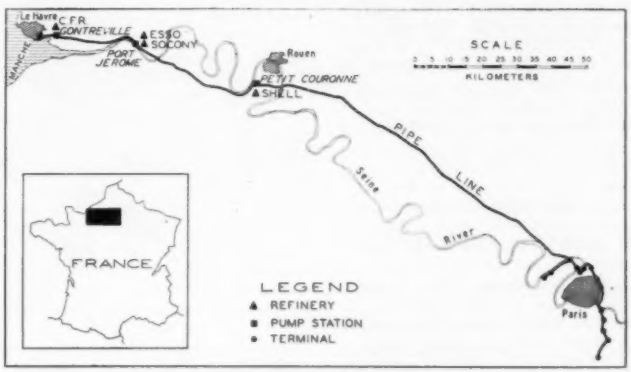
Artery, which is 140 miles long, connects the port of entry and three refineries with the tank farms situated in the Paris region.

FRANCE, which in 1930 became the first country in Europe to establish a refining industry on its national soil, had, in 1939, a total charging capacity of 164,000 bbl. daily.

The refineries were completely destroyed during the war, but, from 1947 to 1952, they were reconstructed, renovated, and enlarged. As a result capacity increased from 30,000 bbl. daily in 1945 to 440,000 bbl. daily in 1952. Consumption of petroleum products is constantly increasing. It will be about 100 million barrels in 1952 compared to 45 million barrels in 1939.

Recently, France has conducted exploratory projects which in 1951 took the form of 800,000 ft. of drilling. This yielded, in the same year, 2,800,000 bbl. of crude oil and 9,700,000,000 cu. ft. of natural gas. This natural gas is distributed in Southwest France by means of a 500-mile pipeline system. The geographic and industrial characteristics of France result in a concentration in the Paris region of 10 per cent of the population. The consumption of petroleum products in that region amount to 20 to 25 per cent of the French total.

*Technical manager, Soc. des Transports Petroliers par Pipe Line (T.R.A.P.I.L.).



Map of the new Le Havre-Paris products line.

Technical Aspects of Pipe Line

This concentration of petroleum consumption around Paris lead to the construction of a pipe line for refined products between Paris and the refineries situated near Le Havre. The construction and operation of this pipe line have been entrusted to the Societe des Transports Petroliers par Pipe Line (T.R.A.P.I.L.), the stockholders of which are the French state, 12 enterprises under state control, and private enterprises in the petroleum industry.

The Le Havre-Paris pipe line, with a length of approximately 140 miles, connects the port of entry of Le Havre, the Gonfreville refinery (Cie. Francaise de Raffinage), the Port Jerome refinery (Esso Standard Francaise), the Gravenchon refinery (Socony-Vacuum Francaise), and the Petit-Couronne refinery (Shell-Berre) with the tank farms situated in the Paris region.

Diameter, quality, and protection . . . Bearing in mind the forecasts for the future, 10-in. diameter appeared to give the most economical solution. Pipe made in France conforms to the specification "high-test line pipe" A.P.I. 5-L.X. The safety factor, computed in accordance with French regulations, in ratio to the tensile strength, has a minimum value of 3 for the maximum considered pressure of 1,000 psi.

The pipe is protected by a conventional coating of glass fiber, wrapped in a coal-tar derivative. The cathodic protection counteracts the effects of electrolysis resulting from the electric currents in the soil. Instruments to check the resistance of the electric coating are conveniently located.

Construction . . . The construction of the pipe line itself conformed to American standards and was carried out with the conventional machinery including ditching machine, bulldozer, coating machine, and side booms. Some rather complex engineering problems had to be solved in the suburbs of Paris, where sometimes underground obstructions necessitated laying the line along public roads. In some regions where the line cuts through inhabited areas, a concrete coating was installed. In any place where leaks could be dangerous to the vicinity, this concrete coating includes at the bottom a kind of channel in the form of a half cylinder, which enables the detection of eventual leaks.

River crossings, especially that of the Seine—first between Le Havre and Rouen, and again in the outskirts of Paris—required the solution of particular problems caused by the regulations of the French Bridges and Roads Administration, and special measures had to be taken in order to impede river traffic as little as possible and to insure permanence of the channel. In each case, a trench was dug in the river bed in which the pipe line was placed to protect against damages which could be caused by dragging boat anchors.

At Aizier, between Rouen and Le Havre, the line was laid on the bank of the Seine and later hauled by tugs into the required position of the river bed, where the line conformed to the terrain.

A trenching machine in action.

View of a pumping-station layout.

Conversely, in the outskirts of Paris at Gennevilliers, the exact outline of the pipe line was constructed on land and then lowered to its final position in the trench.

Pumping stations . . . The four pumping stations are situated at the harbor of Le Havre, near the Gonfreville refinery, near the Port Jerome refinery, and near the Petit Couronne refinery. These stations are equipped with pumps, manufactured in France under license, and with explosionproof electrical motors of 300 hp. The number and the allocation of the pumps were planned in such a way that the stations could function either singly or by series, or be bypassed. The pumps are set up in series and the suction and discharge pressure can be modified as needed, by a simple change of the impellers.

The normal flow of the products is from Le Havre to Paris. However, installations are planned to permit the transportation of petroleum products from the refineries to Le Havre.

Terminals . . . Distribution to the Paris region is effected through 12 intermediate terminals to which are connected the tank farms located near each. A terminal is therefore an installation without tank storage. It consists of valves, piping strainers, and meters, for the purpose of measuring the products, and shifting them to a given storage area.

Operational characteristics . . . The Le Havre-Paris pipe line will transport two grades of gasoline, kerosine, and diesel fuel. The transportation of other products (aviation gasoline, jet fuel, liquefied gases) is also planned.

The function of T.R.A.P.I.L. can be compared to that of the "common carrier" in the United States.

Volumetric meters measure the products at the entry and at the exit of the pipe line. Taking into account the number of tank farms connected in the Paris region (24), the problem of dispatching is particularly complex. The dispatching office is able to calculate an accurate graphical representation of the plan of operations, including the successive arrivals of batches and the passing of the contamination, by means of a paper band unrolling before a set of marks which represent the stations and terminals.

Safety conditions . . . Since the Le Havre-Paris project was the first pipe line for finished products to be built in Europe and the personnel was, at the beginning, likely to lack experience, it was necessary to take maximum safety precautions.

Telecommunications . . . The telecommunication system consists of some lines rented from the French Government and includes, for each station and each terminal, one teletype connected by a direct line to the dispatcher, one telephone connected by direct line to the dispatcher, and one telephone connected to the public circuit.

Safety features . . . Some thermoelectric couples placed on the body of the pumps and in the coils of the electrical motors, set off an automatic alarm in case of any abnormal increase in temperature. The suction and discharge pressures from each pumping station are maintained at a predetermined value, by an automatically regulated valve. If the suction pressure falls too low, or the discharge pressure becomes too high, the motors operating the pumps are stopped automatically.

Any electrical equipment liable to provoke sparks was set far enough from danger spots to conform to French security regulations in hydrocarbon installations.

Moreover, some special arrangements have been made. The air from the

(Continued on page 318)

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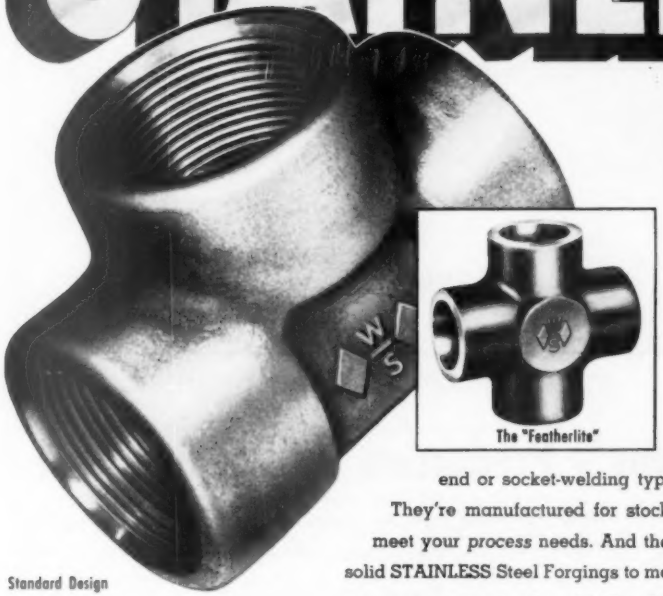

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Drilling rig on location in Germany's Heide field.

Map of German oil and gas facilities.

Western Germany's Production Up 25 Per Cent

Upward trend can be expected to continue for several years due to intensified exploration and development

by A. M. Stahmer

Flowing oil well at Hohne oil field.

THE oil fields of western Germany yielded 9.6 million barrels of crude oil during 1951—26,300 bbl. daily. It is expected that the total production for 1952 will be about 12.2 million barrels (33,400 bbl. daily), nearly 25 per cent more than during 1951.

Due to intensified exploratory and development work using no fewer than 159 rigs, 54 of them being for shallow holes only, it can be anticipated that the upward trend in western Germany's production will continue for at least several more years.

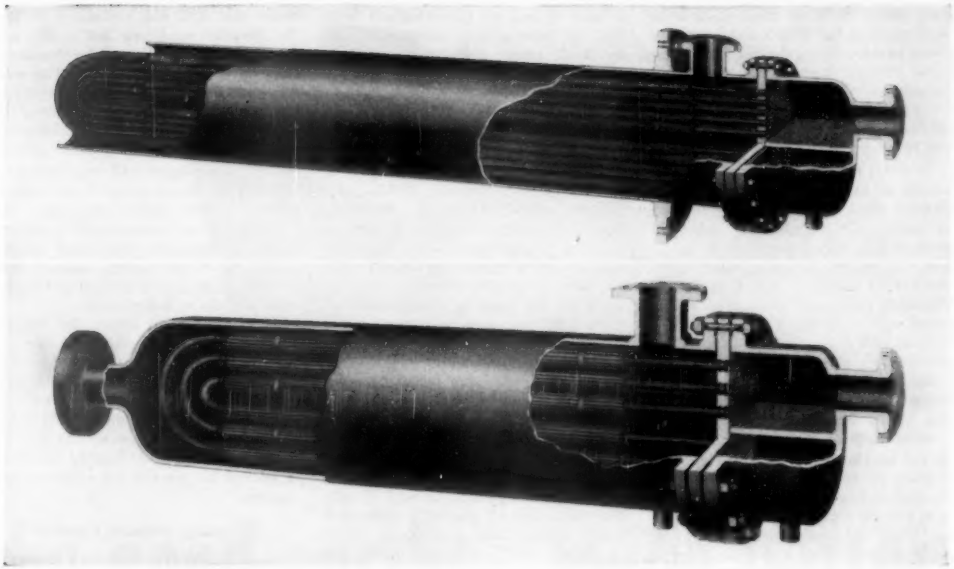
The latest estimates of the German Geological Survey (Amt fuer Bodenforschung) of the underground oil reserves in western Germany showed 285 million barrels, 195 million barrels of which are considered proven and the remainder probable.

Current production is from 2,259 wells of which 1,942 are pumping and 317 are flowing. Average production per well is 15 bbl. daily.

Up to September a total of 1.18 million feet of hole had been drilled during 1952. Oil-producing companies had projected a program of 1.7 million feet for the year.

Success in Schleswig-Holstein

The successes of the oil companies testing deep intermediate structures in the area west and east of the town of Celle highlighted exploration activity in 1951. This year the discovery of oil-saturated Dogger sands in the Province of Schleswig-Holstein is considered the most outstanding development. Prior to this year only two oil fields, Heide and Reitbrook, had been found in the Schleswig-Holstein and adjacent Ham-



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The Line Heaters are used as Suction Heaters to permit easier pumping of viscous oils;—or as Pressure Heaters, either to overcome temperature losses in long lines, or to preheat liquids for further processing.

In all cases the bundles consist of Brown Fintube hairpins rolled into the tube sheet in full compliance with the ASME codes. Metal bands, placed around alternate fintubes, prevent the longitudinal fins from interlocking and restricting the flow. This construction avoids baffling, and permits the liquids being heated to pass through the bundle *unobstructed*, in close contact with the fins and center tubes, with *low pressure drop*. Wide range of standard sizes.

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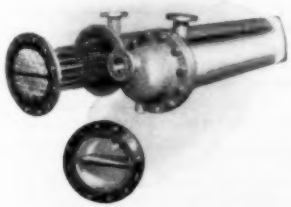

Hairpin Bundle Assembled in Shell Showing Mounting of Tube Sheet Between the Shell and Head.

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burg areas. Both of these discoveries were made in the 1930's and were produced heavily during the last war. These fields produce from Tertiary and Cretaceous rocks and from the basal breccia of the Zechstein, the latter being the main pay on the long, narrow Heide salt structure.

In 1951, Deutsche Erdoel AG. (Dea) started an exploratory test on the deep western flank of the Heide structure. In January 1952 the wildcat, 2-A Hohenwoehrden, was completed as an oil well. It found oil-impregnated sandstone at a depth of 5,935 ft. in the Weladen formation of Lower Cretaceous age. In May, a second well, 3 Hohenwoehrden, struck oil in the Dogger formation (Jurassic). In July, the 5 Hohenwoehrden found an additional Dogger pay known in Hanover Province as the Wesendorf zone.

Meanwhile an important find was reported by Deutsche Vacuum Oel AG., affiliate of Socony-Vacuum Oil Co. At the end of May the company's 1 Boostedt, located about 5 miles southeast of the town of Neumuenster, developed oil production from the lower Dogger at a depth of 5,655 ft. Initial production, through a 4-mm. choke, was 250 bbl. daily of oil with a specific gravity of 0.870. During September 1952 this well produced nearly 6,300 bbl. of oil. The concession at Boostedt is held jointly by Deutsche Vacuum, Deutsche Erdoel, and Preussag. The discovery well was dug on the flank of a salt dome that had been outlined by reflection seismic work. It was the first discovery of commercial quantities of oil in the middle or eastern part of Schleswig-Holstein Province.

North of Boostedt, Deutsche Erdoel holds a concession on which a wildcat, 2 Ploen, located about 7 miles northeast of the Boostedt discovery, found oil in November to open what appears to be the third oil field discovered in the Schleswig-Holstein area this year. Producing zone of 2 Ploen is a sandstone of the Dogger beta formation. The well, drilled on the eastern flank of ths Boostedt-Warnau salt trend, found the pay at a depth of 6,480 ft. The crude oil has a specific gravity of 0.860 and a high gasoline content. This discovery will increase exploratory and drilling activity in other concessions of the province.

Weser-Ems, a New Oil Province

Oil was discovered in south Oldenburg near Quakenbrueck, halfway between Hanover and Emsland, in 1950. The pour point of the crude at Quakenbrueck is so low that the wells can be produced only through electrically heated tubing. Quakenbrueck field has proved to be only a marginal producer; however, the 1 Hemmelte-West 1, a wildcat drilled on Gewerkschaft Brigitta, a joint-interest concession held by Shell, Jersey Standard, and Deutsche Vacuum, has improved the outlook for the area.

The 1 Hemmelte is located northwest of Quakenbrueck in southern Oldenburg. The structure is a faulted anticline. Oil is found in various zones in the Cornbrash (Dogger), Kimmeridge (Malm), and the Wealden. Since the discovery well was completed at the end of 1951, 12 producers have been drilled and an area of more than 1,000 acres has been proved productive. Average depth of the wells is about 4,000 ft. Hemmelte-West field produced nearly 25,000 bbl. of oil in September 1952.

About 25 miles southeast of Hemmelte-West, Wintershall 4 Rehden wildcat found a gas in October 1951. This well was drilled as a stratigraphic test and the diameter of the hole was too small for completion as a producer. A second hole was dug which came in for an initial production of 3.15 million cubic feet of gas daily through a 5-mm. choke from a depth of 7,000 ft. in July 1952. The gas pay is the main dolomite of the Zechstein, the gas-producing formation of the nearby Emsland gas fields. Though no market for the gas has yet been developed this well has stimulated the search for Zechstein gas between the Weser River and the border of Holland.

New Fields in Hanover

Two fields were discovered in the Hanover area by Preussische Bergwerks-und-Huetten AG. (Preussag) in August 1952. A wildcat, 12 Lehrte, located northwest of the town of Lehrte, east of Hanover, encountered the oil-bearing sandstone of the Cornbrash formation at a depth of 3,915-4,025 ft. After overcoming salt-water problems, the wildcat made a free flow of 3 cu. meters of oil daily through a 3-mm. choke. The oil had a specific gravity of 0.871. Structurally the Lehrte well is on the deep western flank of the long, narrow Lehrte-Sehnde-Sarstedt salt uplift which had been drilled several times without success.

Between the small towns of Gifhorn and Wittingern, in the vicinity of the Iron Curtain, an exploratory test of Preussag at Vorhop found oil-bearing sands of the Dogger beta. The well is pumping about 1-2 cu. m. of oil daily. The well is located at the southeastern end of the Vorhop salt dome. Though the Lehrte concession is wholly owned by Preussag, Gewerkschaft Elwerath participates 50 per cent in the Vorhop development.

Results achieved by the 48 Suderbruch well of Gewerkschaft Brigitta-Deutsche Vacuum in Suderbruch field may entail international interest. Originally this well was scheduled to test the Rhaetic sandstone but a blowout occurred while drilling in the Posidonia shale at a depth of 7,680 ft. The well was immediately brought under control. On production tests the well flowed 60 cu. m. of light oil (0.839 specific gravity) per day through a 4-mm. choke.

At first geologists and engineers supposed that the oil came from a small cavern in the shale formation, but the steady flow continues and a second well has developed production in the Posidonia. It now seems assured that flowing production has been developed from a shale at Suderbruch.

Suderbruch field heads the list of producing fields in the Province of Hanover with a yield of 13,000-14,000 tons a month. The young producing area of Hohne ranks second with a monthly output of about 9,000 tons. At Hohne, in addition to the Liassic production, an oil-bearing Dogger sandstone has proved but undeveloped reserves.

Increasing Refinery Capacity

During 1952 the expansion of existing refineries and hydrogenation plants, and the erection of new units continued. Currently the annual capacity of the treating plants amounts to about 7 million tons. Plans to increase this capacity to 9.3 million tons within the next few years are under way.

Two hydrogenation plants resumed partial operation during 1952, the Bottrop-Welheim plant of Ruhroel GmbH. (American Stinnes interests) and the Welheim plant of Scholven-Chemie AG (German State owned). Scholven, which also has an efficient benzene hydrofining process is under contract with the German affiliate of Anglo-Iranian Oil Co.

At the end of September 1952 the new Thermofor catalytic cracking plant (licensed by Socony-Vacuum) of Deutsche Erdoel-AG. at Heide (Holstein) was completed. This is the first catalytic cracking unit in Germany to be put on stream. The capacity of the plant at Heide, which was built by Hydrocarbon Research, Inc., is 300,000 tons a year. In the near future a similar T.C.C. plant will be opened at the Socony-Vacuum refinery in Bremen-Oslebshausen. The hydrogenation plant of Wesseling has completed a thermal cracking plant, combined with a reforming unit, which will allow the flexible three-stage processing of crude. The first stage being distillation, the second cracking of the distillation residue, and the third hydrogenation of the cracking residue.

The adding of new refining capacities corresponds with the increasing demand for petroleum and its products in the Federal Republic of Germany.

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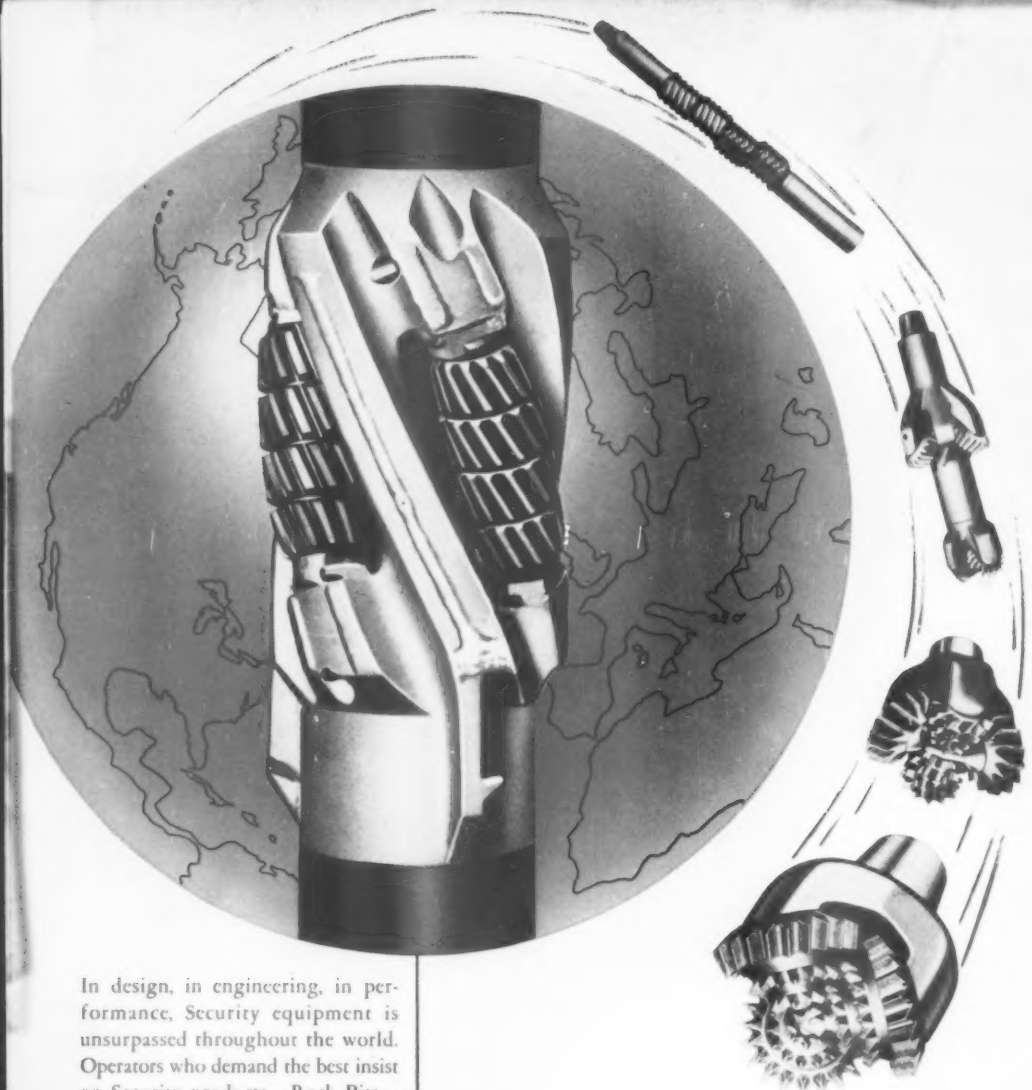

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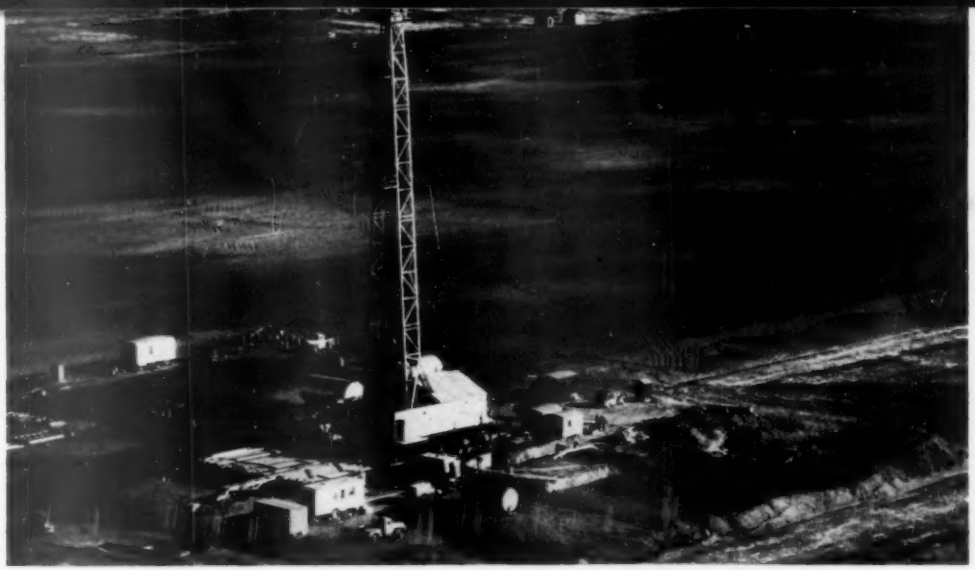


CANADIAN DRILLING ACTIVITY is typified by the above Bluesky 1 well in the Peace River area of Alberta.

Canadian Exploration Activity Is Widespread

. . . but search is intensified in western provinces

Here's a province by province account of development north of the border. While the search spreads over most of the nation, it is centered in the west.

by John F. Caley*

ALTHOUGH the search for natural gas and petroleum is taking place in 8 of the 10 provinces of Canada and in the Northwest Territories, by far the greatest exploratory activity is to be seen in western Canada. Here over 225,000,000 acres,. comprising 10,000,000 acres in Manitoba, 60,000,000 in Saskatchewan, 100,000,000 in Alberta, 30,000,000 in British Columbia, and 25,000,000 in the Northwest Territories are currently held under exploratory permit, reservation, or lease.

This vast region includes most of southeastern Manitoba; virtually all of Saskatchewan south of about latitude 56° 00'; practically all the plains and much of the foothills area of Alberta; the sedimentary area south and west of Great Slave Lake, N. W. T.; and much of northeastern British Columbia.

Alberta

The province of Alberta continues to be the site of most of the drilling currently being carried on in western Canada but recent discoveries in southern and southwestern Saskatchewan, southwestern Manitoba, and northeastern British Columbia have resulted in a notable increase in drilling in these areas over that done in the same period of 1951.

About 177 drilling rigs were operating in Alberta as of late October and about 1,170 wells of all types had been completed. Of the 177 rigs, 102 were on field development work and 75 were on wildcat locations. Exploratory drilling, mostly in the central plains and Peace River areas, resulted in about 100 new strikes of which 45 were gas, 9 were wet gas, and 46 were oil; this represents about 75 per cent of the 133 indicated discoveries made in the four western provinces combined.

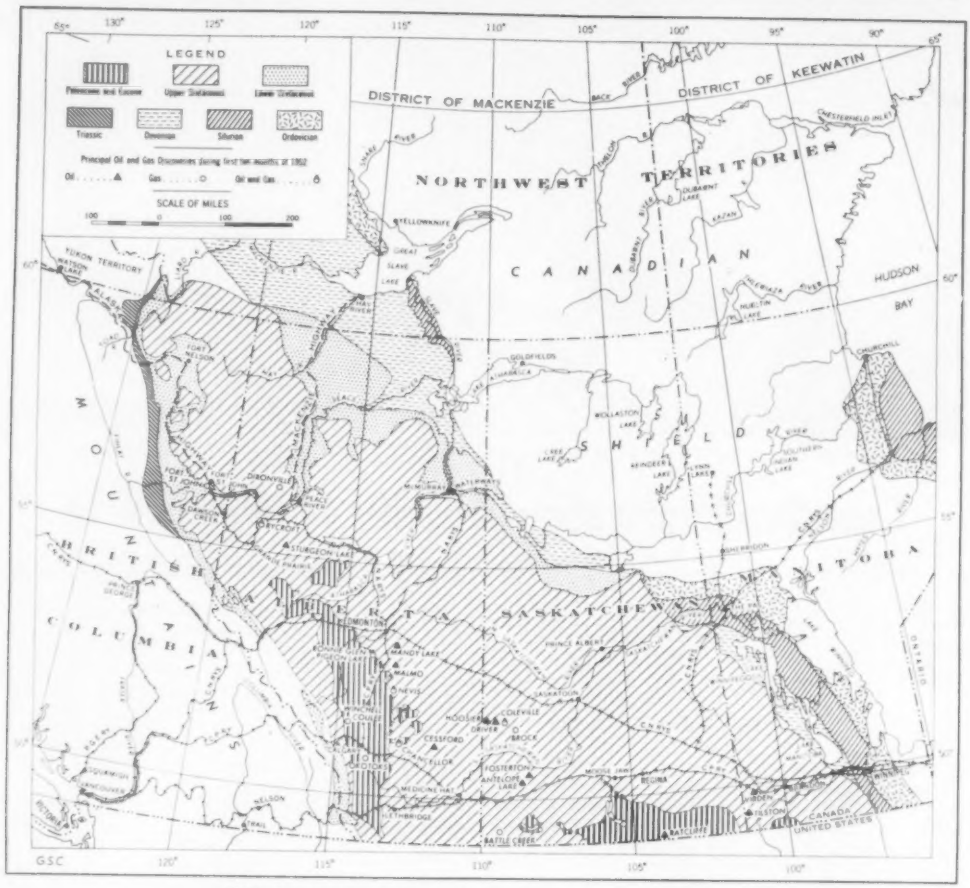
Geophysical exploration . . . This activity reached an all-time peak in western Canada in September with about 183 parties operating at an estimated cost of about $3,000,000 a month. Of the 183 parties, 127, comprising 116 seismograph and 11 gravity-meter parties, were at work in Alberta; 46 parties, including 39 seismograph, 5 gravity-meter, and 2 magnetometer parties, were in Saskatchewan; 5 parties, including 1 gravity-meter and 4 seismograph parties were in Manitoba; and 1 gravity-meter party in the Northwest Territories. Total number of geophysical parties of all types active at the peak in 1951 was about 152.

Production . . . During the first 6 months of 1952, Alberta wells yielded about 24,863,830 bbl. of crude oil. This represents about 97 per cent of the total western Canada production for that period and is almost 6,000,000 bbl. greater than production for the same period of 1951. Total Canadian oil production during this period was 25,905,931 bbl.

At the end of July 1952, about 2,852 Alberta oil wells were being operated. More than 90 per cent of Canada's oil production (48,123,370 bbl. in 1951) is from the province of Alberta. In 1946, the year preceding discovery of Leduc field, Alberta had a production potential at maximum efficient rate, of about 19,000 bbl. of crude oil a day; this has now been increased to an estimated 280,000 bbl. a day, almost 80,000 bbl. a day more than is required to satisfy currently available markets.

The continued increase in oil discoveries in western Canada, most of which are in Alberta, are substantially increasing the recoverable reserves.

*Geological Survey, Department of Mines and Technical Surveys, Ottawa. Published by permission of the Director-General of Scientific Services, Department of Mines and Technical Surveys.



EXPLORATION AREAS for petroleum and natural gas in western Canada.

These have grown from an estimated 45,000,000 bbl. in 1946 to 1,376,000,000* bbl. at the end of 1951.

Estimates made to include 1952 discoveries and field extensions to June 12 show recoverage reserves at that date of about 1,540,340,000* bbl. of oil indicating the addition of nearly 164,000,000 bbl. of recoverable oil in the first half of the current year.

Strike locations . . . Although the 46 or so oil strikes made in Alberta so far this year extend from near the international boundary to the Peace River area a distance of some 550 miles, most are concentrated in the central plains region between Drumheller on the south and Athabasca on the north. Many of these discoveries and indicated discoveries cannot yet be evaluated but it is clear that among them are several new oil fields and that at least one, at Pigeon Lake 25 miles west of Wetaskiwin, will take its place with Turner Valley, Leduc, Redwater, and Wizard Lake to become Canada's fifth major oil field.

Most of the principal oil fields discovered in Alberta since 1947 have been in Upper Devonian reef dolomite and it is estimated that more than 90 per cent of presently known oil reserves are in rocks in Devonian age; the remainder is largely in sands of Cretaceous age. Cretaceous sands, long known to be productive of natural gas in Alberta, notably at Viking-Kinsella, Foremost, Pakowki, and Medicine Hat fields, are now becoming increasingly important as possible oil reservoirs.

Beginning with the discovery of oil in Lower Cretaceous sands at Woodbend in 1948, these sands have subsequently been found productive of oil at several other localities, as at Joseph Lake (Viking sand) in 1949; at Ellerslie and Drumheller in 1950; and at Alliance, Armena, Armisie, Bonnyville, and Camrose in 1951. No fewer than 18 separate oil strikes were made in sands of Cretaceous age during the first 8 months of 1952. It is pointed out, however, that on a basis of reserves, the largest Cretaceous field so far discovered is small when compared with the fields producing from the Upper Devonian reef dolomite.

Perhaps the most spectacular dis-

*Committee on Crude Oil Reserves, Western Canada Petroleum Association.

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Seismograph surveying equipment in area north of Keg River, northwestern Alberta.

covery of 1952 was made in the Bonnie Glen-Pigeon Lake district about 25 miles west of the town of Wetaskiwin. The discovery well, Texaco, Exploration Co. A-1 Bonnie Glen, about 6½ miles southwest of Wizard Lake Devonian field, completed drilling at depth of 7,120 ft. and top of the Leduc formation (D3) was reached at a depth of 6,382 ft. The well penetrated about 688 ft. of D3 reef zone including 397 ft. of wet gas and 291 ft. of 42°-gravity oil making the thickest Devonian D3 productive zone so far found in western Canada. Development of Bonnie Glen field is proceeding rapidly.

In August, Texaco A-1 Pigeon Lake wildcat about 3 miles southwest of Bonnie Glen completed drilling at 7,240 ft.; the Leduc formation (D3) was reached at a depth of 6,674 ft. The productive zone is about 555 ft. thick including 254 ft. of wet gas cap and 300 ft. of about 41.5°-gravity oil. The oil-water interface is at approximately the same level as at Bonnie Glen and although the two areas are not yet joined by drilling it seems certain that they constitute a single field, perhaps of major rank.

About 6 miles southwest of the Pigeon Lake well, Canadian Gulf Oil Co.-Canadian Pacific Railway Co. 4 Fiveland well found wet gas and oil in the Devonian D3 zone as well as gas in the Viking sand (Cretaceous). This well completed drilling late in August at a depth of 7,380 ft.; the Devonian D3 zone was reached at a depth of 6,852 ft. As the gas-oil interface is appreciably lower than at either the Pigeon Lake or Bonnie Glen wells the Fiveland well is thought to be on a separate reef.

Midway between the Texaco Pigeon Lake and the 4 Fiveland wells, still another exploratory venture, Stanolind Oil & Gas Co.-California Standard Co. 1 Pigeon Lake, has recently discovered gas in the Viking sand (Cretaceous) and wet gas and oil in the Devonian D3 zone. These four wells indicate a 15-mile southwest extension of the Devonian reef trend from the Wizard Lake major discovery of 1951.

Nevis discovery . . . The finding of wet gas and oil at Nevis about 14 miles west of Stettler in the central plains region deserves special mention. The discovery well, Gulf 4 Lampert, was completed in August at a total depth of 6,750 ft. The Devonian D2 and D3 zones were reached at depths of 5,520 and 5,650 ft. respectively. Drill-stem tests in the D2 zone gave large gas flows and a small quantity of naphtha, and a thin section in the lower part of the zone yielded 36°-gravity oil. The D3 zone was reported water filled.

DIRECTIONAL DRILLING was used to bring in Imperial Oil Ltd.'s 10-12V Joseph Lake well. A multiple-shot survey instrument was used to maintain proper angle and direction. Joseph Lake is approximately 25 miles southeast of Edmonton.

Three additional wells located 1 mile southeast, 3½ miles northeast and 2 miles northeast respectively of the Lampert well have now been completed. One of these, Federated Petroleums, Ltd.-United Oils, Ltd., 14-2 Nevis, on drill-stem tests of a thick reef section is reported to have yielded gas flows with high distillate content aggregating 30 million cubic feet a day. The open-flow capacity has been estimated at 150 million cubic feet of gas a day.

Another well, Gulf 6 Allison, found large flows of wet gas in the Devonian D2 zone. On flow test this well yielded 32.7°-gravity oil at a rate of 40 bbl. an hour. The recoverable reserve indicated by the four wells in this pool is estimated unofficially at more than 400 billion cubic feet of gas with distillates.

About 32 miles north of Nevis and 3½ miles southwest of the New Norway Devonian oil field, Scurry Explorers 1 New Norway well completed in January, found oil in both the Devonian D2 and D3 zones. The reef zones were reached at depths of 4,951 and 5,253 ft. respectively and the well was placed on dual zone production. Gravity of the oil is about 38.8° from the D2 zone and 34.4° from the D3 zone.

Development drilling followed rapidly and at the end of September the field, known as Malmo field, had about 17 wells on production of which 7 are from the Devonian D2; 5 from the D3; 3 from D2 and D3 (dual zone producers); and 2 from sands of Lower Cretaceous age. The Malmo field thus adds about 4 miles to the Duhamel-New Norway southwest trending productive Devonian reef zone bringing the total length to about 12 miles.

Other discoveries of commercial significance in the southern and central plains region include (1) a new Devonian D3 zone pool in the southeast part of Leduc field; (2) a new Devonian D3 zone pool 2 miles south of the main Stettler field; (3) a new pool or 2-mile south extension of the Bashaw Devonian D3 zone field discovered in 1951; (4) a Devonian oil strike about halfway between Big Valley and Caprona oil fields; (5) a ½-mile north

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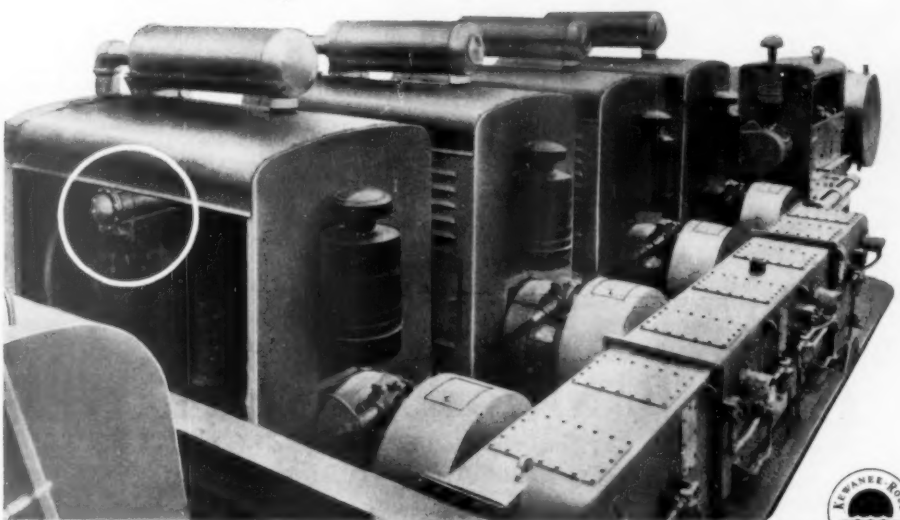

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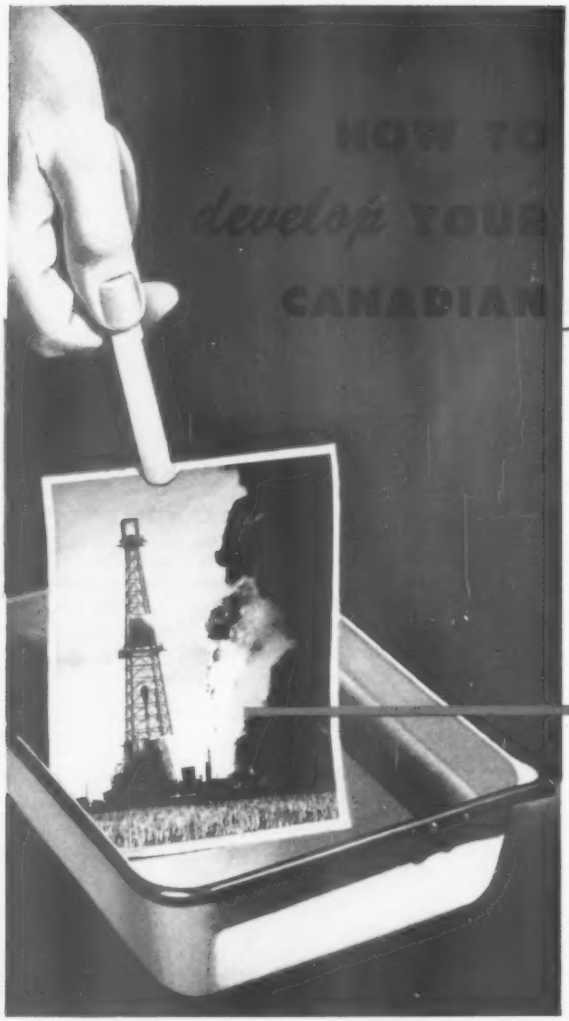

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extension of the Campbell (Cretaceous) oil field; (6) a new discovery of light-gravity crude oil in Mississippian limestone near Three Hills; (7) an indicated 2-mile southeast extension of the Joseph Lake Viking sand (Cretaceous) oil field; (8) the first discovery of heavy oil in commercial quantity in Basal Colorado (Cretaceous) sands near Cessford; and (9) a discovery of light oil in the Sunburst sand (Cretaceous) and an indicated discovery of oil in limestone of Mississippian age at Chancellor.

Peace River area . . . In this area of northern Alberta two discoveries of importance have been made, one in each of the Lower Cretaceous sand and Devonian reef dolomite. Pacific Gas Exploration 1 Rycroft well about 11 miles southeast of the town of Rycroft and 40 miles north of Grande Prairie found both gas and oil in the Cadomin sand near the base of the Lower Cretaceous. Drilling was completed at depth of 6,083 ft. and the well plugged back to 4,440 ft.

The Cadomin sand was reached at a depth of 4,163 ft.; drill-stem tests of interval 4,199 to 4,220 ft. gave a flow of 18° gravity oil at a rate of 4 to 5 bbl. an hour; and tests between depths of 4,181 to 4,210 ft gave gas at a rate of 6.95 M.M.c.f. a day and 100 ft. of oil. The well was capped as a potential gas producer. The gas-bearing part of the formation is about 35 ft. thick and the well therefore represents a gas reserve of substantial size.

The second important event was the finding of a 90-ft. oil-bearing Devonian reef section in a well located in the Sturgeon Lake district about 50 miles east of Grande Prairie. The well, Amerada Petroleum Corp. 'O'F33-32 Crown, completed drilling at a total depth of 9,015 ft. and drill-stem tests in the Devonian between depths of 8,955 and 8,985 ft. gave gas flow at a rate of 250 M.c.f. a day, and 1,440 ft. of oil and 90 ft. of mud.

Devonian reef production in the Peace River area was first obtained at Imperial Oils 1 Normandville wildcat about 50 miles north of Sturgeon Lake in 1949. The Amerada discovery now indicates the possibility of Devonian production in a considerable part of the Peace River area and provides further impetus to the northwestward search from the general Edmonton area to the Northwest Territories where Devonian rocks are productive in Norman Wells field on Mackenzie River.

As already indicated, about 54 individual gas strikes have been made in Alberta during the first 10 months of 1952 and, as in the case of the oil finds, these are distributed from the south-central part of the province to the Peace River district. Large volumes of gas are being discovered during the process of drilling for oil and as local markets within economic reach of the established fields have for some time been adequately supplied, many, if not most of the 1952 gas discoveries remain shut in awaiting further market outlets.

It is generally conceded that markets outside the province of Alberta are necessary to the development of the large reserves already established and that future drilling will undoubtedly result in a substantial increase of these reserves.

Several interests have therefore put forward proposals for the construction of gas pipe lines. One of these, Westcoast Transmission Co., plans to build a line from northern Alberta to Vancouver, Seattle, and Portland. This company has recently received permission from the Alberta government to export gas from the Peace River area of Alberta, and from the Board of Transport Commissioners in Ottawa to construct the Canadian part of the proposed line. Application for entry of the gas to the United States is now before the Federal Power Commission at Washington.

Gas finds . . . Among the more important gas finds of 1952 are those made in Lower Cretaceous sands at Gordondale, Dixonville, and Rycroft in the Peace River area; in Lower Cretaceous sands at Winchell Coulee, Chancellor, Lac La Biche, Clive, Fort Saskatchewan, Big Lake, Morinville and Stettler, in the central and southern plains region; in the Viking sand (Upper Cretaceous) at Hanna, Westlock, Nisku and Ryley; in Mississippian limestone at Minnehik; and in Devonian strata at Nevis, Pigeon Lake and Okotoks.

Reference has already been made to the discovery of wet gas in the Devonian reef formation at Nevis and Pigeon Lake, and some indication of the magnitude and importance of these finds has been given. In its report of March 1952 the Alberta Petroleum and Natural Gas Conservation Board stated the expectation that "with a continued incentive for exploration for oil and gas resulting in the drilling of some 400 to 500 wildcat wells per year, the Province of Alberta can safely anticipate the development of further established reserves of natural gas at an average rate of at least 1 trillion cubic feet a year for at least the next 8 to 10 years"!

The 400-billion-cubic-foot gas reserve indicated by the Nevis discovery (4 wells) is thus seen to be 40 per cent of the above average annual increase predicted by the conservation board. If the recently estimated reserves* of 42 M.M.c.f. and 57 M.M.c.f. respectively for the Gordondale and Rycroft discoveries of the Peace River area are added, these three discoveries are seen to account for approximately one-half of the predicted annual increase in the Alberta gas reserves.

The importance of the Devonian wet-gas discovery made by Shell Oil Co. of Canada near Okotoks 20 miles south of Calgary in 1951 has been confirmed by completion of two additional wells. The discovery well, Shell 1 MacKid, completed drilling in strata of Cambrian age at a total depth of 10,501 ft. and was plugged back to 9,685 ft. The top of the Devonian productive zone was reached at a depth of 8,142 ft. Initial production was 3,150 M.c.f. of gas a day and the indicated potential has been reported at 25,000 M.c.f. ft. of gas a day.

The two wells completed this year, Shell 1 Herr about 1 mile northwest of the discovery well, and Shell 1 Shattuck about 1 mile north-northeast of Shell 1 Herr have each obtained large flows of sulfur-bearing wet gas from rocks of Devonian age. The sulfur content of Okotoks field gas is reported to be about 32 per cent by volume and is the highest so far known in Canada. In addition this gas yields about 3 bbl. of condensate per million cubic feet of gas.

Saskatchewan

Saskatchewan is currently undergoing the greatest exploratory activity in its history with more than 60,000,000 acres under permit or lease. In October, 46 geophysical parties, including 39 seismograph, 5 gravity-meter, and 2 magnetometer parties were in the field. At the same time 38 drilling rigs were active, of which 11 were on development work and 27 on exploratory locations. During the first 6 months of the year, about 100 wells of all types had been drilled; 59 of these were development and extension wells and 41 were wildcats.

The exploratory drilling has had considerable success, resulting in 22 strikes of which 16 were oil and 6 were gas. Geologically, nine of the oil finds were in sands of Lower Cretaceous age; two were in the Viking sand

*G. S. Hume and A. Ignatieff: "Natural Gas Reserves of the Peace River Area, British Columbia and Alberta," Canada, Department of Mines nd Technical Surveys, September 1952.

(Upper Cretaceous); three were in strata of Mississippian age; and two were in rocks of Jurassic age. One indicated oil strike was made in Devonian rocks.

Of the gas discoveries, five were in the Viking sand and one was in the Jurassic. Oil production in August was about 165,928 bbl. from 264 wells bringing the year's total to that date to 1,054,896 bbl. Oil production for the entire year 1951 was about 1,245,911 bbl. It is significant that about 30 per cent of the oil produced during the month of August came from 38 wells in Coleville field discovered date in 1951.

The Fosterton district, about 30 miles northwest of Swift Current, witnessed the first discovery of medium light oil in Saskatchewan. The discovery well, Socony-Vacuum Exploration Co.-Western Prairie Exploration Co., Ltd. 1 Fosterton, reached the Lower Cretaceous productive zone at a depth of about 3,065 ft., and on a 4-hour initial potential test through a ¼-in. choke the well flowed 24°-gravity oil at a rate of 298 bbl. daily.

Subsequent drilling has resulted in completion of nine wells capable of production and the productive potential of this pool is now estimated at about 300 bbl. of oil a day through ¼-in. choke. Only one well was on production from this pool in August and the yield was 4,599 bbl. of oil.

Three additional discoveries were made in this general area. About 8½ miles southeast of Fosterton pool, Socony-Western Prairie 2-14 Cantuar well discovered two Lower Cretaceous productive zones separated by about 40 ft. of strata. Drill-stem tests of the upper zone at depths between 3,202 and 3,288 ft. recovered 23°-gravity oil; gravity of the oil from the lower zone is about 12°. Cantuar pool now has three wells capable of production.

About 10 miles east of Fosterton and 7½ miles northeast of the Cantuar dual-zone discovery, Socony-Western Prairie 3-6B Success well made a strike of 22.6°-gravity oil in Lower Cretaceous sands at a depth of about 3,100 ft. The third oil discovery in the general Fosterton area was made in the Antelope Lake district about 15 miles southwest of Fosterton pool. Here Socony-Western Prairie 1 Midway well found two productive zones in rock of Jurassic age. The first zone, reached at depth of about 3,445 ft., yielded heavy oil of about 18° gravity; the second, at depth of about 3,510 ft., gave a slightly lighter oil of about 21.5° gravity.

At Driver, about 4 miles west of Coleville oil and gas field, Canada Southern-Albercan 4 Driver well made the first discovery of light (33°) gravity oil in the Viking sand (Cretaceous) in Saskatchewan at a depth of about 2,265 ft. Initial drill-stem tests of the Viking sand also gave natural-gas flow at rate of 270 M.c.f. a day.

Drilling was continued to a depth of about 2,720 ft. thought to be in Devonian green shale. A zone saturated with heavy oil was found in the Banff sand (Mississippian) at a depth of about 2,636 ft. and preliminary investigation suggests that this may be the same zone found to be productive in Coleville field. Subsequent drilling has resulted in four natural-gas wells in this district.

In the Williston basin near Ratcliffe 5 miles north of the international boundary and 100 miles southeast of the city of Regina, Socony-Central Del Rio 1 Ratcliffe well found strong indication of light (31° to 35°) oil in rocks of Mississippian age. It is planned to continued drilling to about 9,500 ft. to test the Devonian formations before thoroughly testing the Mississippian section for commercial production. The well is about 65 miles northwest of Amerada 1 Iverson in North Dakota which completed as a commercial producer after acidization in the Mississippian limestone.

About 250 miles west of Ratcliffe in the extreme southwest part of the province gas in commercial volume was found in Jurassic strata at the Imperial et al 4-31-3-26 Battle Creek well. This well also encountered heavy oil saturation in Mississippian rocks at a depth of about 4,420 ft. In the Eastend district, about 45 miles northeast of the Battle Creek well, Tide Water-Eastend 1 Crown well made the first discovery of oil in substantial quantity from Jurassic strata at depth of about 4,740 ft. During a short test medium-gravity (20 to 21°) oil is reported to have flowed intermittently at a rate of 34 bbl. an hour.

Coleville development . . . Coleville oil and gas field discovered in August 1951 about 100 miles southeast of Lloydminster underwent rapid development during the first part of 1952 and in September the field had 57 oil wells and 4 gas wells capable of production. The oil is 13° to 15° gravity and the productive zone is thought to be a more or less local development of clean sand in the Banff formation of Mississippian age immediately overlying the Devonian "Exshaw" shale.

In the discovery well the oil zone was reached at a depth of about 2,685 ft. and after the wall was completed and placed on pump, it produced about 80 bbl. of oil a day. Gas production at Coleville is from the Viking Upper Cretaceous sand which, in the discovery well, was reached at a depth of about 2,273 ft. Drill-stem tests at this depth gave gas flow approximating 6,000 M.c.f. a day.

Gas from two of the four productive wells has been used for heating the heavy oil for transmission through the field gathering lines. Only the northeastern limit of the field has been defined and development drilling is continuing. Cumulative oil production to the end of August was about 209,220 bbl. and the indicated productive potential of the field is now about 3,000 bbl. of oil a day.

At the present time gas production in Saskatchewan is from Lloydminster, Lone Rock, Unity, and Kamsack fields which, in August, had a combined yield of 57,975 M.c.f. of gas.

During the current year, further extensions have been made to the Brock Viking sand (Cretaceous) field which now has nine wells capable of production. This field, 15 miles east of Kindersley, is at present shut in awaiting market outlet.

Several new gas discoveries were made in the Viking and Lower Cretaceous sands. At D'Arcy, 8 miles east of Brock field, Sohio Petroleum Co. 1 D'Arcy well obtained gas in the Viking sand with an initial potential of 12,000 M.c.f. a day. About 30 miles northwest of this well and 3 miles east of Coleville field, Canada Southern 1 Eureka well also discovered gas in the Viking sand. Drill-stem test of interval 2,249 to 2,272 ft. gave gas flow at a rate of 1,170 M.c.f. a day.

At St. Florence 6 miles south of Coleville oil and gas field, Phillips-Husky 1 St. Florence well found gas in both the Viking sand and the Lower Cretaceous as well as evidence of oil in the Banff sand, the productive zone at Coleville. The well was completed as a gas well in Cretaceous sands with an estimated open flow potential of 24,000 M.c.f. of gas a day.

Manitoba

Interest in the oil and gas possibilities of southwestern Manitoba was greatly increased in 1950 when the Souris Valley Oil Co. 1 Downey well near the international boundary obtained a significant show of light oil in Mississippian limestone at a depth of about 3,223 ft.

The first production in commercial quantity came the following year with

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discovery of 33°-gravity oil by California Standard Co. in Mississippian strata about 9 miles west of the town of Virden, some 50 miles north of Downey location. This discovery together with the finding of oil in the adjoining Williston basin area of North Dakota gave still further impetus to the search for oil in Manitoba with the result that exploratory activity is now greater than at any previous time.

Reference has been made to the fact that some 10,000,000 acres in southwestern Manitoba is currently held under permit or lease. In October four geophysical parties, consisting of one gravity-meter and three seismograph parties, were in the field and 11 drilling rigs were at work of which 5 were drilling development wells and 6 were on wildcat locations. Significant extensions to Virden oil pool discovered in 1951 and one new discovery as well as encouragement at other locations have resulted from the 1952 drilling.

A new discovery was made in July by California Standard 5-32 Tilston Province well, about 24 miles southwest of Virden pool. The oil is in Mississippian limestone at a depth of about 3,100 ft. First production was in August during which month the well yielded about 750 bbl. of oil. Later in the year an indicated discovery was made about 6 miles north of Virden pool when Bailey-Selburn Oil & Gas, Ltd., and California Standard 2-21 Hargrave well found light oil (32°) in Mississippian limestone. The well is currently receiving treatment and there is every hope that production of commercial significance will result.

Results near Virden . . . Perhaps the most promising results so far obtained have been in the vicinity of Virden field discovered in 1951. In May, Canadian Superior Oil of California, Ltd., 14-4 Cruickshank well indicated a 2½-mile west extension of Virden field. This well found production in Mississippian limestone between depths of 2,515 and 2,530 ft. and daily potential of 52 bbl. of 34°-gravity oil is indicated by preliminary testing.

Two other productive wells have now been completed in this pool.

About 1½ miles southwest of Virden field another extension or small pool was discovered by Souris Valley Oil Co. 1 Coulter well. Still another successful completion was made in the northwest part of Virden field where New Concord Development Co. et al 1 Virden well penetrated a 61-ft. productive zone in the Mississippian reached at a depth of 2,240 ft.

First oil production in Manitoba began in February 1951 and total production for that year was about 11,765 bbl. Production for the first half of 1952 was about 13,422 bbl. of oil, a daily average of 74 bbl. During August a total of 3,906 bbl. of oil was produced by eight wells in the Virden area. This area now has about 15 wells capable of production and it is confidentally expected that before the end of 1952, oil production in Manitoba will reach 1,000 bbl. a day.

British Columbia

The finding of light oil in Peace River Natural Gas Co.-Allied Oil Producers, Ltd. 1 Fort St. John well 6 miles southeast of Fort St. John in November 1951 gave great impetus to exploration for oil and gas in the Peace River area of northeastern British Columbia. More than 29,000,000 acres is now under permit in this area and applications for permits on an additional 2,000,000 acres have been filed with the provincial authorities. Permits aggregating almost 2,000,000 acres in the Fernie, Quesnel, Fort George, Lillooet, and Fort Fraser districts are also held by interested companies.

Five geophysical parties including one magnetometer and four seismograph parties were operating during September, and seven exploratory and five development wells were in various stages of drilling. Except for one well in the Flathead district of southeastern British Columbia and one near the confluence of the Toad and Liard rivers about 260 miles northwest of Fort St. John, all exploratory drilling is in the Fort St. John area.

The Toad River well is located on Toad River anticline recently mapped by the Geological Survey of Canada. Drilling commenced on rocks of Triassic age and it is planned to test the possibilities of the underlying Paleozoic formations which will require an estimated 6,500 ft. of drilling. Operations were suspended for the winter months at a depth of 1,643 ft. The Flathead well about 25 miles west of Pincher Creek gas field was drilling at a depth of 8,938 ft. at last report. This well is reported to have encountered moderate gas flows at a depth of about 5,411 ft.

The increased activity in the Fort St. John district has now resulted in the general outlining of a large northwest trending gas-distillate structure some 12 miles long with reserves* currently estimated at about 1,500 billion cubic feet of gas making the discovery one of the most spectacular achievements of 1952.

On August 31, nine wells had been drilled on the Fort St. John structural feature. This drilling has shown that "three structures, all part of a general uplift in the Fort St. John area, are productive*. The structures have productive zones in each of the Lower Cretaceous, Triassic, and Permo-Pennsylvanian systems at depths ranging from about 2,000 to 6,300 ft., a feature which makes the general area extremely attractive for exploration.

*G. S. Hume and A. Ignatieff: "Natural Gas Reserves of the Peace River Area, British Columbia and Alberta," Canada, Department of Mines and Technical Surveys, September 1952.

Northwest Territories

The presence of oil in commercial quantity in Devonian rocks in the Northwest Territories has been known since 1920 when the discovery well of Norman Wells field on Mackenzie River near the Arctic Circle was drilled. This field was developed to its present status during World War II and currently operates only for local requirements.

Gently dipping limestones, shales, and dolomites of Middle and Upper Devonian ages have long been known on the west arm of Great Slave Lake 350 miles southeast of Norman Wells and oil seepages have been observed at Windy Point and elsewhere in this general vicinity. The discovery of oil in Devonian strata at Normandville and at Sturgeon Lake in the Peace River area of Alberta, and the finding of a small volume of gas near Fort Providence in 1951 have stimulated the northwestward trend of exploratory activity and test drilling.

On Deep Bay, Northwest Territories Petroleums has drilled two wells; the first N. W. T. 1 Deep Bay was abandoned in the Devonian Slave Point limestone at a depth of 1,321 ft. The second, N. W. T. 2 Deep Bay about 2½ miles northwest of No. 1 had reached a depth of 846 ft. at the end of May. Each of these wells is reported to have encountered oil staining in the Slave Point formation.

In the same general district Punch Petroleums, Ltd., has drilled three 2½-in. diamond-drill core test holes. The first hole is reported to have found good oil saturation with evidence of natural gas in a 90-ft. section of the Slave Point limestone between depths of 366 to 456 ft. The second hole, located about 3 miles northwest of No. 1 hole is also reported to have found indication of oil in the Slave Point limestone.

About 20 miles east of Fort Simpson, West Territories Oil Ltd., is carrying out plans for the drilling of four stratigraphic tests.

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TYPICAL OF THE EXTENSIVE PROGRAM for refinery expansion is this project now nearing completion at the Imperial Oil, Ltd., Sarnia plant, the nation's largest. Included are a 46,500-bbl. per day atmospheric and vacuum distillation unit, left, and a 23,250-bbl.

Canadian Refineries Are Moving Toward Meeting

Canada boasts the greatest postwar growth in petroleum demand of any major nation. Consumption has more than doubled, and refiners are hard pressed to meet the rise.

RANKING second only to the United States in per capita consumption of petroleum, Canada is fast moving toward the ultimate goal of self-sufficiency in that source of energy. In 1952 the country is estimated to have met about 37 per cent of total requirements from domestic crude, as compared with 8.1 per cent in 1947.

From the manufacturing standpoint, however, it appears that within the near future, domestic refining capacity will be adequate to meet practically all of the country's needs for finished products. The phenomenal postwar development of prairie crude reserves has received world-wide attention. Also important but less appreciated outside Canada is the record rate at which refiners have been expanding and modernizing their facilities over the past 5 years.

Since the war Canada has shown the greatest growth in petroleum demand of any major nation in the world. Total consumption of petroleum products has more than doubled since 1946, rising as much as 20 per cent in a single year. Refiners have been hard pressed to meet this rise in demand with domestically refined products.

The completion of several major plant-construction projects this year will result in some slackening in building activity over the next few months. But 1953 will see the beginning of a number of new projects, and refining capacity is expected to reach 500,000 bbl. per day before 1954.

During the past 6 years, new refinery construction has been paced by Canada's four largest operators: Imperial Oil, Ltd.; British American Oil Co., Ltd.; McColl-Frontenac Oil Co., Ltd.; and Shell Oil Co. of Canada, Ltd. The first major postwar expansion program took place at Montreal East where all four companies modernized their operations with catalytic cracking and related facilities, and more than doubled throughput capacity.

Western crude discoveries sparked a second major building program which began in Alberta and continued eastward as pipe-line construction made new domestic production available to refineries in Saskatchewan, Manitoba, and last year, via the Great Lakes, to southeastern Ontario. This expansion program in Central Canada is still under way. In general, the larger refiners have completed most of their projects involving new refineries and expansion and modernization of existing ones, although some work remains for the next 2 years. Now beginning is a round of plant construction by several smaller refiners in the three prairie provinces and Ontario.

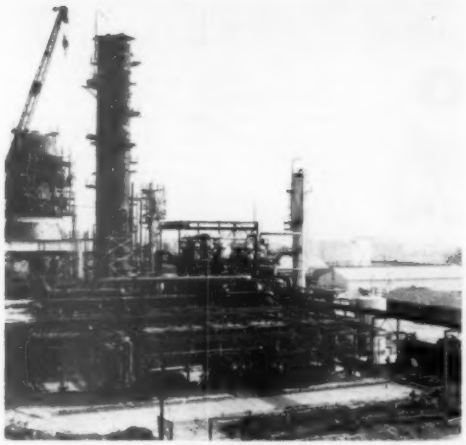
British Columbia is now receiving attention, with two programs under way and others expected. This phase of expansion results from the building of the Trans Mountain Pipe Line from Alberta to the Pacific Coast.

A continuation of the record demand trend of the recent past may call for a second postwar round of expansion in many Canadian refineries. In general, refiners have found it necessary drastically to revise their long-range expansion plans, as product demand rose beyond all earlier estimates.

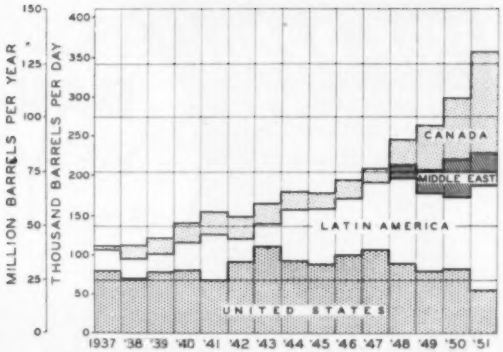
Montreal is an example. Although capacity was doubled during 1948-1950, some refiners now find their facilities already inadequate to meet the requirements of the market area formerly served from that refining center. Until recently it appeared that a second postwar round of refinery expansion was due shortly at Montreal East.

But recent developments to the west have modified the situation to some extent. Plans of Interprovincial Pipe Line Co. to extend its crude line from Superior to Sarnia place added emphasis on southern Ontario as a growing refining center. Designed for an ultimate capacity of 300,000 bbl. per day, this system will provide a continuous supply of domestic crude to the Sarnia area, eliminating the winter interruption of Great Lakes tanker shipments.

Montreal refineries operate wholly on imported crude, supplied by a pipe line from Portland, Me. Present operations are in balance with the line's capacity, and any sizable expansion of



per day Model IV fluid catalytic cracking unit, right. Total crude capacity will be increased from 55,500 to 71,000 bbl. per day.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MIDDLE EAST
LATIN AMERICA
UNITED STATES
1937 '38 '39 '40 '41 '42 '43 '44 '45 '46 '47 '48 '49 '50 '51

CAPACITY AND OPERATION of Canadian refineries. Fig. 1.

by George Weber
Refining Editor

Record Domestic Demand

operations at Montreal East would necessitate increasing the line's capacity. Thus, while some new construction may be undertaken at Montreal in the next year or two, it appears that an increasing share of the big eastern market will in the future be supplied out of the Sarnia and Toronto areas. Sarnia may well succeed Montreal as Canada's largest refining center in the next few years.

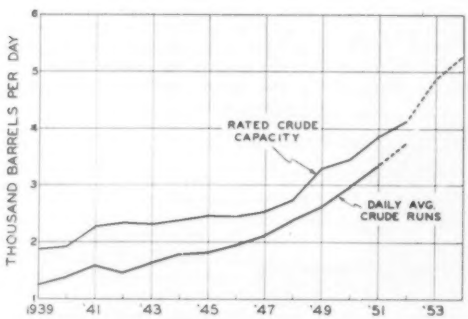
New Construction Projects

British Columbia... The three existing plants grouped near Vancouver now provide half of the province's needs for petroleum products, the remainder coming from California plants. Until last October, when Imperial began westward rail shipments of about 5,400 bbl. per day from Alberta, British Columbia refiners were wholly dependent on imported crude. Up to 1951 California crude was charged to stills almost exclusively. Since then, about 20 per cent of the crude supply has arrived in tankers from Borneo, a temporary measure made necessary by shortages of California crude.

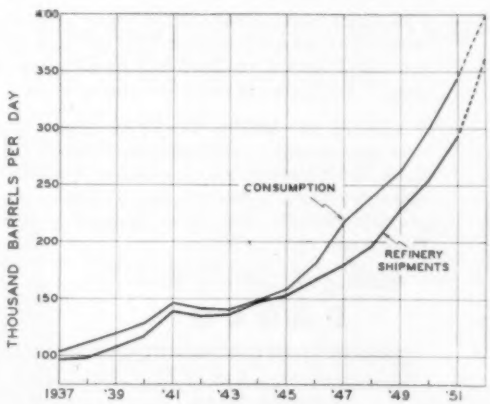
On completion of the Trans Mountain line next year, British Columbia plants will convert 100 per cent to domestic crude. Within 2 years refining operations in that province will probably double, to meet the full requirements of the Pacific Coast market north of the border. Imperial is under way on a project expanding the 12,000-bbl. per day Ioco plant to 22,500 bbl. per day. Shell is doubling capacity from 7,000 to 15,000 bbl. per day at the Shellburn plant. Both plants will incorporate catalytic cracking and will be completed as the first crude moves into the Vancouver area through the Trans Mountain line.

Standard Oil Co. of British Columbia, Ltd., is studying plans for expanding and modernizing the 8,350-bbl. per day Stanovan plant, but have not yet determined the extent of the program. British American is also considering a Pacific Coast refinery. This year the company completed the purchase of 350 acres on Burrard Inlet near Vancouver.

Prairie provinces... In Alberta, Saskatchewan, and Manitoba refinery ca-



CRUDE RECEIPTS by Canadian refineries. Fig. 2.



TOTAL LIQUID FUELS, Canadian consumption and domestic refinery shipments. Fig. 3.

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pacity has been expanded more than threefold since the war. The program included the building of three complete new refineries and the expansion of four existing ones, by Imperial, British American, and McColl-Frontenac. Construction continues. Imperial will invest $7,000,000 in the Regina plant, adding vacuum distillation, fluid catalytic cracking, and increasing capacity slightly. British American, which recently completed modernizing and expanding its Moose Jaw refinery, may next undertake new construction at the Calgary refinery. McColl-Frontenac, which built a new refinery at Edmonton 2 years ago, has purchased a site at Winnipeg and is understood to be considering the building of a second new plant.

Independent refiners in the prairie provinces are now following the trend with plans for modernized facilities. At Regina, Consumers' Co-operative Refineries, Ltd., formerly named Saskatchewan Federated Co-operatives, Ltd., has begun a $5,500,000 project doubling capacity to 12,000 bbl. per day and adding facilities for vacuum distillation, catalytic cracking, polymerization gas recovery, and L.P.G. manufacture.

Moose Jaw Refineries, Ltd., is adding a 300-bbl. per day catalytic reforming and desulfurization unit at the small Moose Jaw, Saskatchewan plant. Anglo-Canadian Oils, Ltd., reports that it is working on engineering for some possible construction next year at the Brandon, Man., refinery. In Saskatchewan, Royalite Oil Co., Ltd. and Canada Southern Oils, Ltd. have announced plans to build a 5,000-bbl. per day refinery near the Coleville field, which they own jointly. The plant is to go on stream in 1953. In addition, they have purchased the 1,000-bbl. per day skimming plant of Prince Albert Refineries, Ltd. at Prince Albert, which was rated last year at 500 bbl. per day.

Husky Oil & Refining, Ltd. is adding a new vacuum unit and a new asphalt specialties plant at Lloydminster, Alberta. Two other independent refiners in the prairie provinces have advanced plans for modernization programs which include new catalytic cracking units.

Ontario . . . For the past year, Canada's largest refinery construction projects have centered around Sarnia, and both Sarnia and Toronto areas will continue to expand in operating capacity. Canadian Oil Refineries, Ltd., last summer placed its new 20,000-bbl. per day refinery on stream at Corunna, south of Sarnia, and is contemplating further refinements in operations. Imperial will complete a major project at Sarnia near the end of this year.

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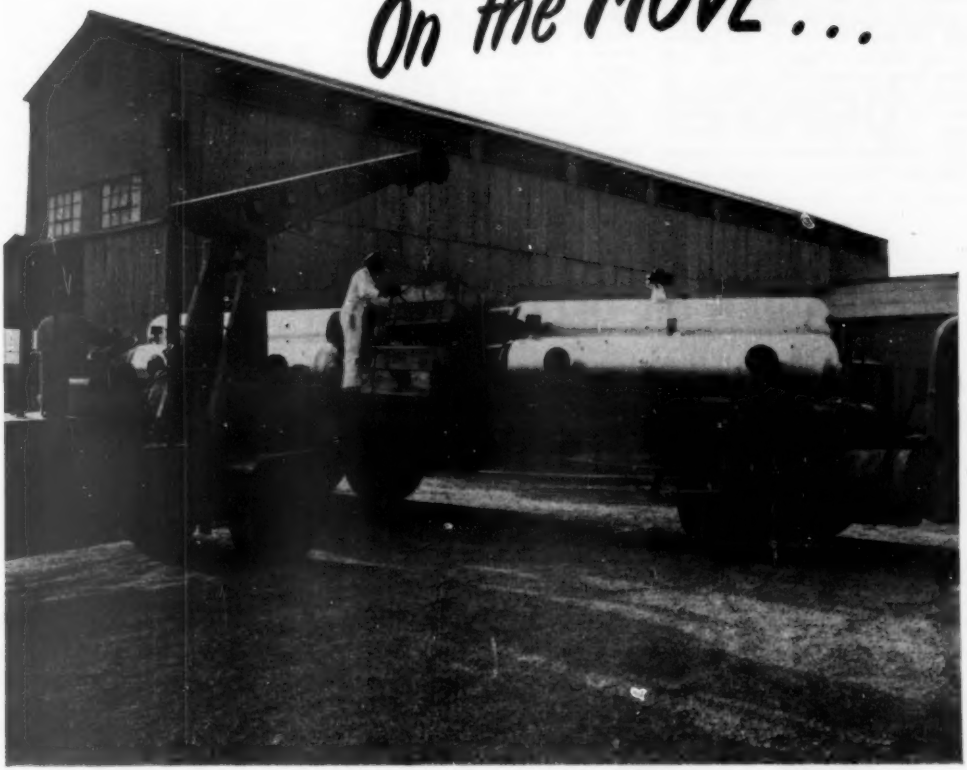

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boosting capacity from 55,500 to 71,000 bbl. per day. Both programs include new catalytic cracking facilities, and the C.O.R. plant incorporates Canada's first Platforming unit.

Sun Oil Co., a newcomer to Canadian refining, is beginning construction of a complete new plant, reported to have a capacity of 10,000 to 15,000 bbl. per day. In view of the general feeling among Canadian refiners that they have underbuilt on capacity in recent years, this plant is considered likely to be nearer 15,000 bbl. per day than 10,000. Shell, which operates two Canadian refineries at Montreal East and Vancouver, is known to be considering the building of a third plant, somewhere in Central Canada. It is believed probable that they will pick the Sarnia area.

Along the Lake Ontario shore west of Toronto, two new construction projects are planned. British American has contracted for the building of an 8,000-bbl. per day Orthoflow fluid catalytic cracking unit at Clarkson. Trinidad Leaseholds, Ltd., expects shortly to announce a modernization program for the Port Credit plant which will double capacity and include catalytic cracking or catalytic reforming facilities, or both.

In western Ontario, a small 4,000 bbl. per day skimming plant recently moved from Texas was placed in operation near the end of the year at Fort William by Riverlake Oils, Ltd. Located on the Lake Superior shore northeast of Superior - Duluth, this plant will operate for a local market.

Quebec and Maritimes . . . While some new projects for Montreal East are in the thinking stage, no important expansion of facilities is expected in eastern Canada in the foreseeable future.

Crude Runs

Fig. 1 plots Canadian runs to stills, based on reports of the Dominion Bureau of Statistics, with the 1952 rate estimated from incomplete figures. It appears that the upward slope of the curve during the past 4 years will probably hold for the next 2 years.

Rated crude capacity for 1953-1954 is estimated on the basis of construction projects under way, plus additional programs which are considered firmly committed. Total capacity should reach about 504,000 bbl. per day by the end of 1953, and 549,000 bbl. per day by the end of 1954.

Since the war, over $300,000,000 has been invested in refinery expansion. It was impossible to finance this exceptional building program out of company earnings, but through sales of investments, bonds, debentures, and company stock the new facilities were largely financed with Canadian capital. United States capital has had a smaller share in building Canadian refineries than in developing western crude reserves.

Crude Imports

Despite the rapid rise in utilization of domestic crude (Fig. 2) Canadian refiners still rely largely on imported charge stocks. Imports reached an all-time high in 1951, but Canadian crude accounted for most of the increase in crude receipts by refineries. The peak in total crude imports may have been reached during 1952, and a steady downward trend will become evident next year.

United States imports dropped from 85,000 bbl. per day in 1950, to around 60,000 bbl. per day during 1951 and the first half of 1952, due mainly to reduced shipments into Ontario. Imports from Borneo, averaging better than 3,500 bbl. per day since early 1951, have reduced United States receipts in British Columbia somewhat. Shipments north to the prairie provinces have dwindled almost to zero. Late next year movements on the order of 17,000 bbl. per day to British Columbia will be eliminated, and Ontario receipts are expected to be reduced by

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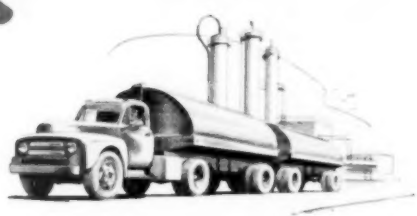

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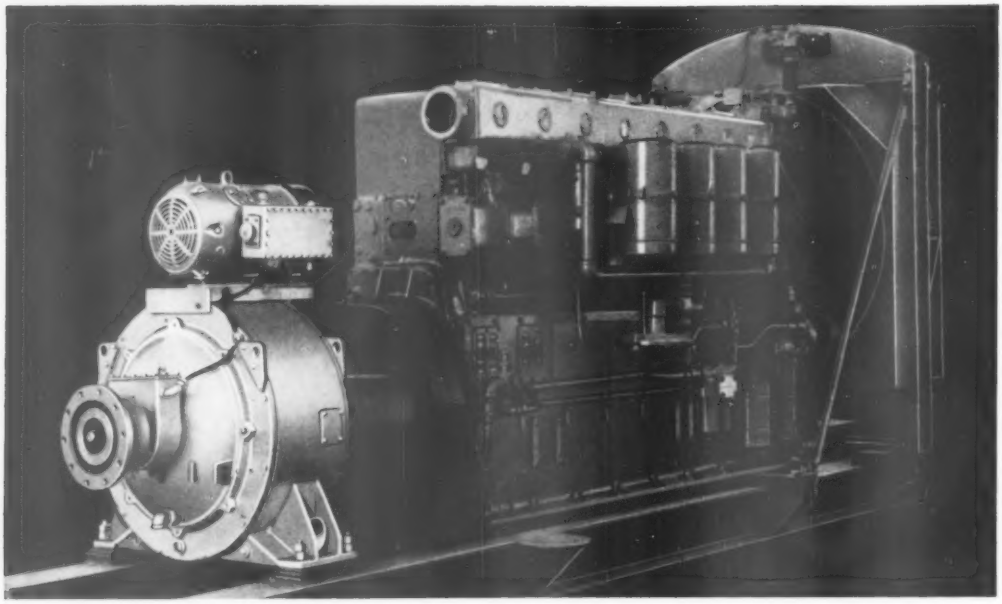

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direct Interprovincial pipe-line deliveries to Sarnia.

With the exception of small shipments of Trinidad crude to Ontario, averaging less than 5,000 bbl. per day, all imports from Latin America during the past few years have consisted of Venezuela crude to five refineries in Montreal and Halifax. These have averaged close to 125,000 bbl. per day since January 1951. Heavy receipts of Arabian crude by those eastern refineries averaged nearly 50,000 bbl. per day in 1950. They dropped off to average 37,000 bbl. per day last year, and less than 20,000 bbl. per day during the first half of 1952, being replaced largely by Venezuelan shipments.

Processing Trends

The middle distillates, including home-heating oil, diesel fuel, etc., have shown by far the greatest percentage increase in demand since the war. The 1951 consumption of this type of fuel showed a 173 per cent increase over 1946, as compared with a 64 per cent increase in gasoline and an 85 per cent increase in residual-fuel uses.

The extensive modernization of Canadian refineries has permitted a marked increase in the yield of these middle distillates. Catalytic cracking capacity represented by only one unit in 1946 stood at about 9.4 per cent of total crude capacity for the nation as a whole. Today, despite the substantial addition of new crude capacity, catalytic cracking capacity in ten units, represents about 23.2 per cent of total crude capacity. New construction over the next 2 years will bring the ratio up to about 34.5 per cent.

Total liquid fuels produced by Canadian refineries during 1951 (Fig. 3) comprised 50.4 per cent light distillates, 26.3 per cent middle distillates, and 23.3 per cent residuals. By comparison, total liquid fuels shipped from Canadian refineries in 1946 consisted of 55.4 per cent light distillates, 19.3 per cent middle distillates, and 25.3 per cent residuals. The estimated domestic consumption of liquid fuels is derived by the Canadian Bureau of Statistics by applying to domestic refinery shipments, the net difference between imports and exports and adjusting for changes in marketing inventories. They do not include heavy fuel imports for bunkering purposes and some other fuel imports by independent jobbers.

Figures released for the first half of 1952 indicate a reduction in the recent heavy imports of finished fuels. Projected Canadian refinery expansion in the next 2 years is expected further to bring domestic fuel production more in line with total consumption.

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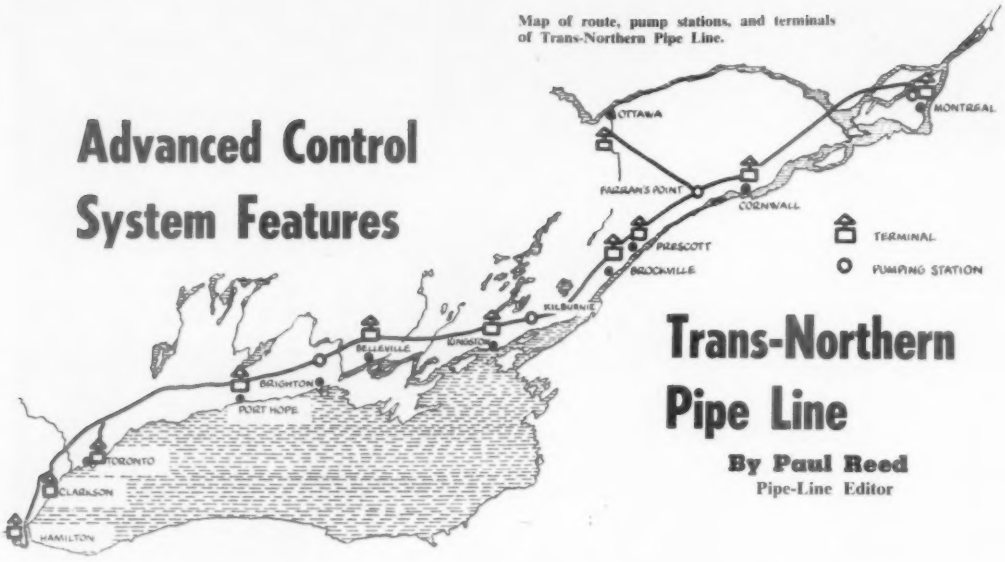

Map of route, pump stations, and terminals of Trans-Northern Pipe Line.

Trans-Northern Pipe Line

By Paul Reed
Pipe-Line Editor

Line utilizes three types of controls at the station for throttling, regulation of pumping power, and for safeguarding pumping units.

THE entire 442-mile products pipe line from Montreal Que., via Toronto, Ont., has been built by Trans-Northern Pipe Line Co. during the remarkably short period of the summer and fall months of this year. In the face of obstacles characteristic of this area along the St. Lawrence River and Lake Ontario, the project was completed in time to receive the initial shipment at Montreal on November 1, within 5 months after the first pipe was welded.

The advanced design and construction of the Trans-Northern project has been done under the direction of A. N. Horne, president and general manager, who supervised operations for the building of some of the world's largest petroleum pipe lines, including the War Emergency Big-inch and Little Big-inch from Texas to New York, the Basin System from New Mexico to Oklahoma, and the Trans-Arabian Pipe Line from the Persian Gulf to the Mediterranean.

Ownership in the Trans-Northern project is equally shared by British American Oil Co., Ltd., McColl-Frontenac Co., Ltd., and Shell Oil Co. of Canada, Ltd.

These companies joined in the undertaking to achieve the economic advantages of flexibility and continuity of pipe-line transportation in an area where tanker movements are stopped by ice for 5 months each year. Faced with the need of meeting the 10 per cent annual increase in demand between Montreal and the Hamilton-To-

Pulling first section of pontoon-supported pipe into Lake Ontario near Burlington, in the Hamilton Harbor area.

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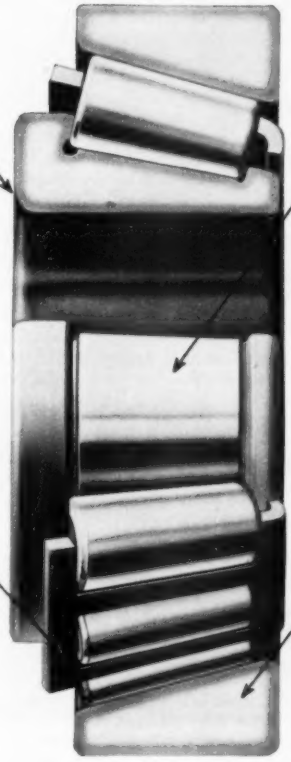

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ronto area, these three companies preferred to build the $19,000,000 Trans-Northern system rather than consider the larger investment which would be entailed in an alternative program for additional tankers and the necessary storage for carrying supplies through the winter months.

Dependable daily delivery and flexibility will give these companies important advantages in the Toronto area which now becomes the point where products refined from foreign crude oil will meet those products made from western Canadian oil.

Since the Trans-Northern system will be operated as a plant facility serving the three owner companies, the emphasis will be on economical transportation. The line will not be operated for profit.

The system consists of a 400-mile, 10-in. line with a 42-mile, 8-in. lateral from Farran's point near Cornwall, Ont., to Ottawa. The four pump stations are being equipped for an initial daily capacity of 40,000 bbl. By additional units, capacity can be increased later to 75,000 bbl. daily.

Nineteen refined products to be handled include motor gasolines, diesel fuel, and stove and furnace oils. The line can also be used for L.P.G.

Among the notable engineering features, discussed in this article, is the utilization of three types of controls at the station for throttling, regulation of pumping power, and safeguarding of the pumping units. The separation of control building from pump building is a new departure.

Approximately 43 per cent of the line is coated and wrapped.

The pipe line has no tanks since all movements are from and to shipper's storage at refineries and 10 terminals.

An innovation is the arrangement for laying 30 miles of Trans-Northern's 10-in. trunk line in the same ditch with a 10-in. line of Imperial Oil, Ltd.'s new Sarnia-Toronto system, resulting in substantial savings for both companies.

Reversed flow operation is contemplated in the Clarkson-Toronto section which will be further described later.

Construction of the pipe line was contracted by Mannix, Limited, of Calgary and Toronto; Williams Brothers Corp. (Canada), Limited, Tulsa, and Sparling Davis, of Edmonton and Toronto. Ross & Anglin, of Montreal, built the pump stations.

Pump Stations

Station buildings . . . These have been planned so that controls are placed in a separate building located 50 ft. from the pump building for safety reasons. Station sites have been selected so that the pump houses may be slightly lower than the control houses. Through the window in front of the control console, the operator has a full view of the pump house but does not look into it.

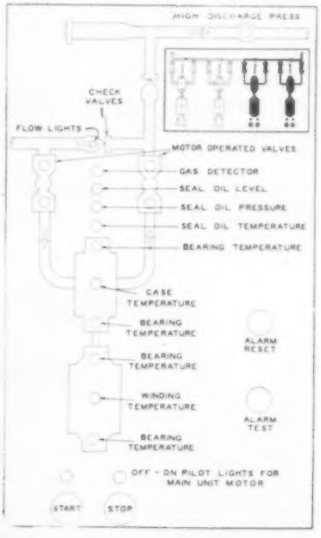
Controls . . . At the heart of station operation is the control system which has three main features:

1. Throttling at the discharge side of the station is accomplished by the Hydron valve, originally developed by Shell Oil Co. Since this valve is completely hydraulic in its operation, it avoids the disadvantages of pneumatic throttling equipment which would require dehydrators in a cold climate. Furthermore, the valve functions entirely independently of the other controus. Discharge pressures will be between 850 and 1,000 psi. Minimum suction pressure will be 50 psi.

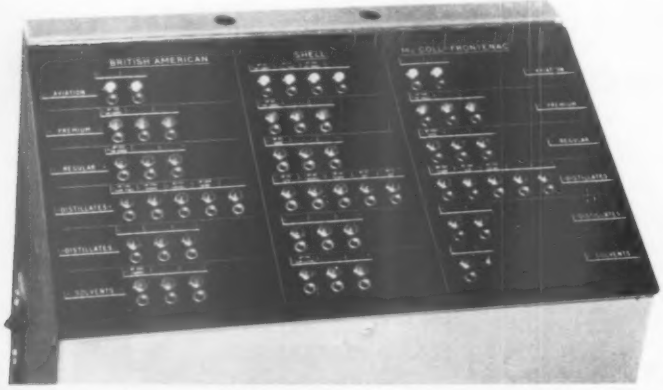
2. Pumping units are regulated by a Teldyne electronic integrator and differentiator of remote pressure transmitter type. This is actuated by differential suction and discharge pressures at the station to automatically start or stop pumping units to meet the hydraulic requirements of the pipe line's pumping program. Steps are initiated by limit switches on a pressure rise or decline. This equipment, as well as the Mercoid controls, is tied to the same electric control system of the station. But the Teldyne and Mercoid controls function independently.

While the Mercoid switches function according to conditions at individual pumping units, the Teldyne control system is actuated by the differential range or throttling loss across the Hydron valve. The Teldyne "floats" with line throughput and operates electrically for starting or shutting down a unit.

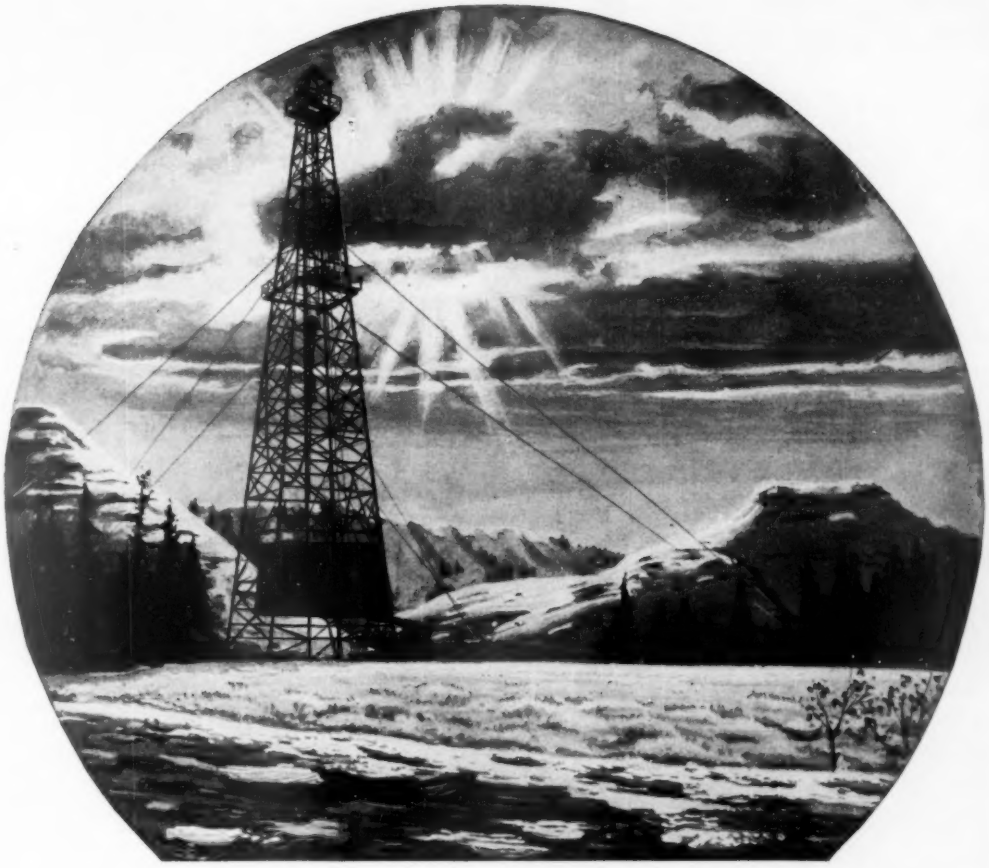
3. Safeguarding of pumping units is accomplished by Mercoid switches which shut down individual units when



Console control-board diagram: The small insert drawing (upper right) reproduces the diagram on the console control board of each station. The four units indicated include two units initially installed and two units to be added later. The larger scale drawing (left) is a detail of the console diagram, furnished with signal lights to indicate the status of operating conditions and lighted arrows to show flow through the piping. The four larger circles in the diagram indicate positions of push buttons for starting and stopping pump motors and for alarm reset and test.



Specially designed foolproof switchboard, which by plugging in any one of the connections, automatically and remotely controls the closing and opening of motor-operated valves and the shutting down and starting of pumps for discontinuing and handling shipments from three refineries to a single 3-mile line running to the Montreal terminal.



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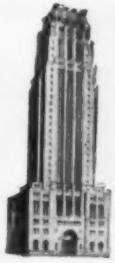

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pressure or mechanical conditions exceed conditions for safe operation. They initiate stopping units according to the settings of the instruments. A Mercoid operates a mechanism for tripping a switch to shut down an individual pumping unit.

Control console and board . . . Pumping units are started and stopped by push buttons actuating series of operations familiar in modern pipe-line practice. The lucite sheet on the control desk has a diagram of all units, piping, and valves with lights to indicate units in operation, and the opened and closed condition of valves. Lighted arrows show the direction of flow.

Valves at the scraper traps are manually operated. All other valves are motor operated and controlled by push button from the control desk.

Strain gage . . . Since all indicator and recording instruments are of the strain-gage type, the company has the advantage of an electrical system which eliminates hazards incident to running control lines carrying liquid to the control room.

Instruments at the control board continuously indicate and record suction and discharge pressures of units and the line and also differential pressures across the Hydron valve.

Lights on the control desk and an audible siren indicate dangerous conditions.

In addition to the signals for low suction and high discharge pressures, there are also signals for indicating location of trouble which causes shut down by Mercoid switches due to overheating of outboard bearings, overheating of motor windings, excessive case pressures, insufficient seal-oil pressure, excessive seal-oil temperature, insufficient seal-oil liquid level, stoppage of sump pump, and occurrence of leaks which cause station shutdown by the gas detector.

Seal oil . . . A pressurized seal-oil system in connection with double mechanical seals for the pumps maintains a differential of 25 to 50 psi. pressure above the first-stage pump pressure. This seal system has a small rotary pump for maintaining continuous seal-oil flow and pressure. Any leakage of seal oil would be within the pump and not outward.

An ionized aqueous solution serves as an isolating fluid between product, from the first-stage discharge of the pump, and the seal oil. Any leakage of the seal oil would cause the isolating fluid to move forward to a point where an electric contact would give a signal at the control board.

The safety provisions of this pressurized seal-oil system would be particularly valuable when L.P.G. may be transported.

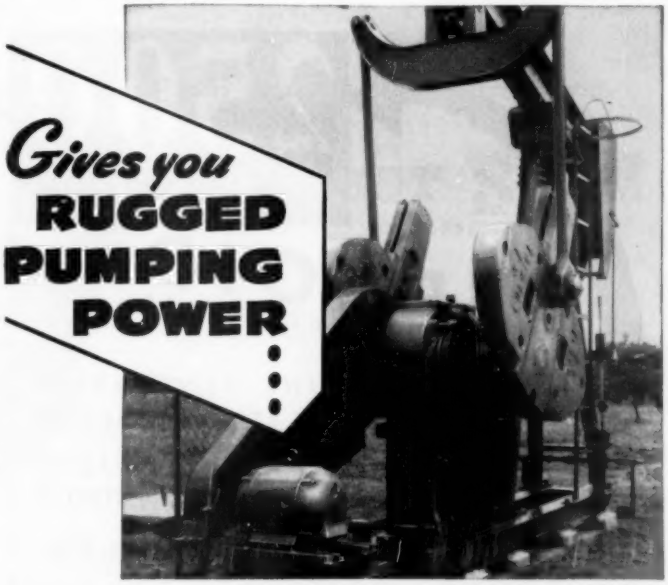
Sump level . . . Sump pumps are operated by float-actuated automatic controls which provide for constant drainage of sumps. Stoppage of the pump is signaled to the control board.

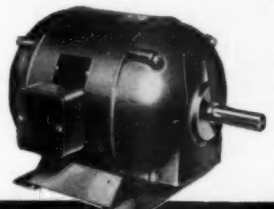
Remote control . . . The comprehensive provisions for station control and safe operation would facilitate remote control if it should be desirable in the future.

Electronic gravitometer . . . The arrival of tender heads or batch changes will be identified by an electronic gravitometer which detects gravity changes by difference in the dielectric strength of products.

Motors . . . Each of the four stations will have two 600-hp., 3,600-r.p.m, 2,300-volt, 3-phase explosionproof motors. These are the first explosionproof motors of so large a size to be built in Canada.

Auxiliary electrical equipment . . . This was furnished as a package unit including switch gear, outdoor substation, motor control section, auxiliary control section, and control desk.





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Pumps . . . The two pumps at each station are four-stage, 6 by 8 by 10½-in. centrifugal pumps which have been modified from standard design.

Pump and motors in the pump house are not separated by a fire-wall because of the sefety of the explosion-proof motors.

As a result of the provisions for safeguarding the control house by its remoteness from the pump house and the absence of liquid lines to serve pressure instruments, there is no need for pressurizing the control rooms. Thus, special ventilating equipment is eliminated.

Two residences for operators are provided at each station with the exception of the initial station at Montreal.

The plan is to have each of the two operators stand a 24-hour shift on alternate days. Since duties will consist of only watching for batch changes and keeping the station clean, the operators are free to go to their houses when the routine does not require them.

Expansion of capacity has been planned in five stages:

1. Initial installation of two 600-hp. units at each of four stations at Montreal, Quebec, Farrans Point, Kilburnie, and Brighton, Ont. Capacity 40,000 bbl. daily.

2. The addition of a unit to give three 600-hp. units per station to result in a total capacity 50,000 bbl. daily.

3. The building of intermediate booster stations halfway between initial stations. Each booster station would have two 600-hp. units which will probably be remotely controlled to achieve total capacity of 60,000 bbl. daily.

4. The addition of a half-unit of 300 hp. at all stations including the initial and booster stations for total capacity of 75,000 bbl.

5. Further expansion of capacity would be provided by looping.

Station buildings and residences are built of buff brick with modernistic design.

Communication will be entirely by teletype over facilities of the Bell system.

Dispatching is handled from the Toronto headquarters office. All movements on the line are scheduled according to a self-winding, self-correlating electric clock at the Toronto office. Dispatching will be done according to practices developed by the Shell products line systems in the United States.

Terminals . . . All shipments are metered on receipt at Montreal and on delivery at the other nine terminals at Cornwall, Prescott, Brockville, Kingston, Belleville, Brighton, Toronto, Clarkson and Hamilton, Ont.

Meters are equipped with a new type of dual Brodie meter head developed for Trans-Northern. A lever is thrown without a clutch to engage one or the other of the twin meters. This insures positive metering and accurate recording on the tickets.

For protecting meters against excessive wear, hay tanks are only used at the Montreal terminal. At all terminals, there are filters of a special design which were made by Trans-Northern.

At the Montreal end of the Trans-Northern system the shipper's three refineries deliver products to the terminal through a single line 3 miles long. Correct sequence of closing and opening valves is assured by a special foolproof switchboard designed to function uniformly under all of the possible operating conditions. The operator at the pipe-line terminal manipulates the switchboard by inserting a plug in an opening much as a P.B.X. operator would do for a telephone switchboard.

To insure against contamination, an upstream shipper on discontinuing a delivery, could be directed to pump into the 3-mile delivery line a product

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Electric Resistance and Fusion Weld—Plain End	8⅝" to 20" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅝" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, Calif.
Electric Fusion Weld—Expanded—Plain End	22" to 30" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser

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of the same kind as that going into the line from the downstream shipper scheduled to make the next shipment.

Between Clarkson and Toronto, the direction of flow may be reversed as required to accommodate British American's deliveries from its refinery at Clarkson to Toronto.

Pipe protection . . . Pipe was coated and wrapped for 45 per cent of the length of the line after a complete survey of the line. In the protected sections the pipe was covered with coal-tar enamel, glass mat, and asbestos felt. At river and stream crossings this protective material was further shielded by wooden slats.

During pipe laying the contractors installed 17-lb. double-packed magnesium anodes for cathodic protection of certain bare sections of the pipe. Additional anodes will be installed for this purpose in the future as required.

The terrain is generally rolling and rocky. The glacial soil is thin in most areas along the route. The longest water crossing extended 7,700 ft. at the Lake of Two Mountains. Around Hamilton Harbor the line runs 3½ miles along the causeway and under the ship channel at 40 ft. depth. All water crossings were inspected by divers.

Welding was inspected by gamma-ray and X-ray photography. After completion, the line was tested by water pressure at 1,350 psi.

Probably the most unusual feature of construction was the laying of the 10-in. line of Trans-Northern and the 10-in. line of Imperial in a single 42-in. ditch simultaneously during construction for a distance of 30 miles in an area in the vicinity of Toronto, where only narrow space was available. Right-of-way easements in this section had previously been acquired by both companies. This is believed to be the first occasion where such double pipe laying has been simultaneously done by two companies.

Acquisition of right-of-way for the 440 miles of Trans-Northern was equivalent to that for a 1,000-mile line in the United States, because 2,900 easements had to be procured owing to the narrow strip land division which is characteristic of the area along the St. Lawrence River.

Engineering and design for the project were guided by an engineering committee from the three owner companies.

W. G. Sexton represented British American, S. S. Smith and R. K. Schulze, Shell, and R. W. Phillips and W. B. Blank, McColl-Frontenac. Phillips, on loan to McColl-Frontenac from Texas Empire Pipe Line, Tulsa, acted as chief engineer during the design period. Blank, likewise on loan from Texas Empire, was responsible for electric design and continued through construction as acting chief engineer.

J. R. Childs, acting as supervisor, oil movements, on loan from Shell Products Pipe Line, and directed by W. J. Curry, Shell chief dispatcher, New York, was given the task of organizing plans and procedures, and training operating personnel.

E. J. Kennelly, acting as superintendent, operations and maintenance, organized and trained operators and maintenance personnel.

There are only two officers of Trans-Northern; A. N. Horne, president, and Herbert H. Brondson, secretary-treasurer, who was formerly with British American.

The owning companies are represented on the board of directors of Trans-Northern Pipe Line Co. as follows: McColl-Frontenac Oil Co., Ltd., by T. C. Twyman and A. G. Farguarson; British American Oil Co., Ltd., by R. E. Kepke and J. R. Dawson; and Shell Oil Co. of Canada, Ltd., by W. M. V. Ash and R. P. Ritchie.

The Trans-Northern system promises to be of increasing significance in the Hamilton-Toronto-Montreal area which is undergoing a period of extensive development.

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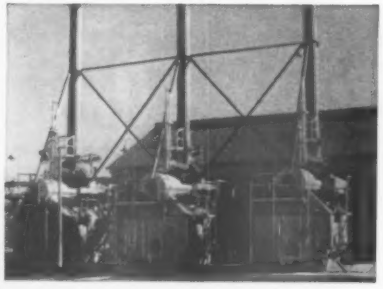

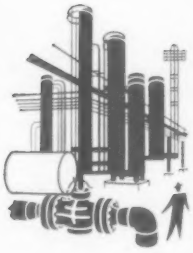

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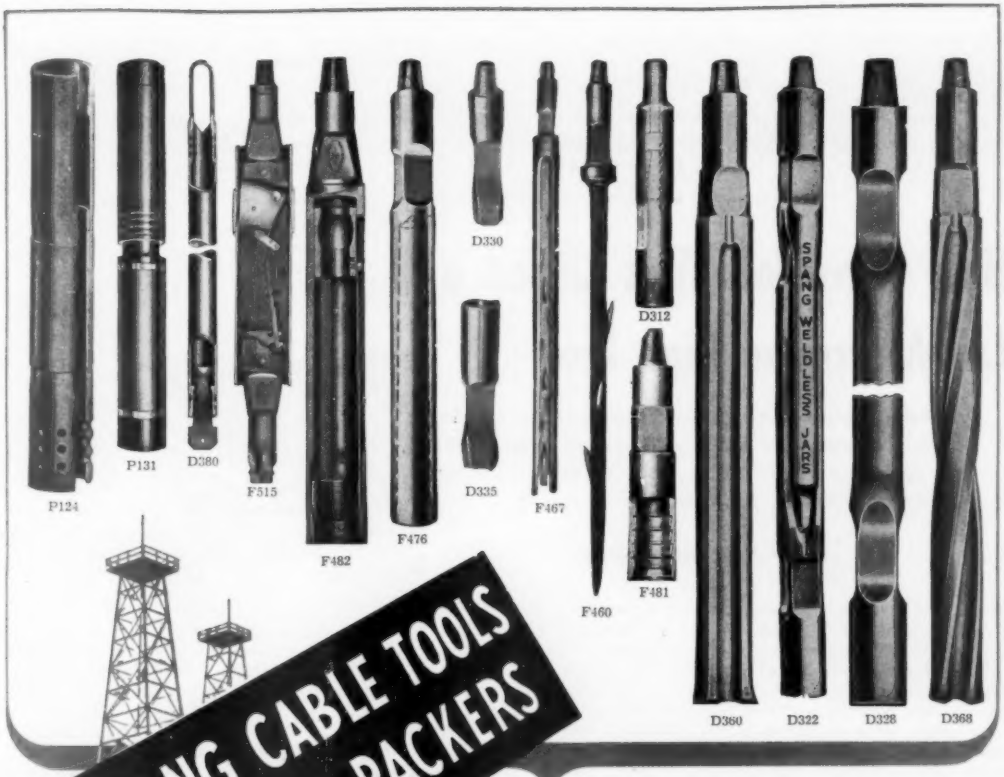

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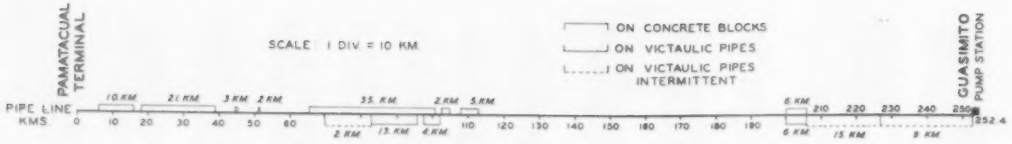

Fig. 1. Locations of line supports for Las Mercedes crude-oil line; situation in April, 1951.

How Corrosion Was Licked on Las Mercedes Pipe Line

Western part of crude line was put on blocks in 1951, as result of large number of leaks; surveys of eastern half are to be made to determine feasibility of cathodic protection or blocking.

by Eric G. Molnar*

Fig. 2. Las Mercedes crude-oil line from Guasimito to the Caribbean Sea.

THE Las Mercedes pipe line, 16 in. in diameter and 157 miles long, transports crude oil from the central part of Venezuela to the Caribbean Sea. Completed in June 1948, the line was laid bare on the ground over most of its length. Where it had to be buried, it was painted, wrapped with asbestos paper, and coated with pipe-line enamel.

Beginning in the latter part of 1950, an ever-increasing number of leaks were caused by corrosive attack. As the result of this corrosion, the eastern part of the line was raised on concrete blocks, and magnesium anodes were installed at the most important road and river crossings.

Corrosion in this part of the line then became noticeably mitigated.

Survey results . . . During the second half of 1951, leaks began to develop in the western part of the pipe line which was still lying on the ground; these became more frequent in 1952. As a result, a survey was made of representative sections of the line. The main findings were the following:

1. The magnesium anodes had raised the pipe-to-soil potential in the blocked-up section to larger negative values, thus lending cathodic protection in this area.

2. The impressed current showed wide spreading, thus indicating that long stretches of the line are cathodically protected.

3. A small number of magnesium anodes had noticeably raised the pipe-to-soil potential in a section which is in contact with the ground. It is probable, however, that seasonal influences are partially responsible for these changes.

In order to decide which portion of the increase of the negative potential is due to the effect of the magnesium anodes and which to the seasonal changes, one 32-lb. anode will be installed every 1,500 ft. along an 18-mile test section. After about 10 weeks, another survey will be made. Based on the results obtained, it will then be protected cathodically by anodes only, or raised on blocks along its entire length.

Brief Review of Pipe-Line Data

Main line and pump station . . . The crude oil produced in the Las Mercedes area in the State of Guarico, in the central part of Venezuela, is carried to the Caribbean coast by means of a pipe line, 16 in. in diameter and 157 miles long. The line has a capacity of about 60,000 bbl. daily at 800 psi. and was constructed by Soc. Anma. Petrolera Las Mercedes (S.A.P.L.M.), sole operator of the field which presently produces about 26,000 bbl. daily from about 210 wells. The first oil was pumped through the line in June 1948.

The initial and only station for the Las Mercedes oil is near Guasimito in the northern part of the Las Mercedes area. This pump station is equipped with two 800-hp., 8-cylinder, 330-r.p.m. gas engines. These drive two three-stage centrifugal pumps having capacities of 1,925 g.p.m. at 3,550 r.p.m. Field gas is used to drive the engines.

The Las Mercedes line was built of pipe which showed the following specifications: Line pipe, o.d. 16.0 in.; wall thickness .250 in.; thus i.d. 15.5 in. Grade B. Weight per foot 42.05 lb. Yield strength per square inch 40,000 psi. tested at 1,000 psi. The minimum tensile strength of grade B pipe is 60,000 psi. River crossings were specified as 16-in. o.d., weight 82.77 lb. per foot and 0.500-in. wall. A.P.I. test pressure on this pipe is 1,300 psi. Further specifications: Electric weld line pipe, plain end, beveled 30° for welding, double random length, up to 50 ft. maximum coated with clear lacquer.

According to the records, 825,976 ft. of 16-in. line pipe of .250-in. wall thickness was used in the main-line construction; for the river crossings 2,188 ft. of 16-in. line pipe of .500-in. wall was employed. Furthermore, 60 ft. of 18-in. casing was used as protection underneath the Barcelona road near the Neveri River and 164 ft. of 24-in. casing under the Barcelona highway crossing near pipe line Km. 19; 40 ft. of 24-in. casing was used under the road crossing to the technical camp inside the Pamatacual terminal.

Capacity of the pipe line is 193,276.2 bbl. at 7.4805 gal. per cubic foot and 42.0 U. S. gallons per barrel.

Between the scraper box at Pamatacual and that at Guasimito there are eight 16-in. gate valves, all insulated.

At about 45 miles distance from Guasimito, an 8-in. line enters into the Las Mercedes line. Through this line crude oil produced in Tucupido, Saban, and Ruiz fields of Venezuelan Atlantic Refining Co. is pumped into the main line and further on to the Pamatacual terminal, where this company has two 130,000-bbl. storage tanks to keep the wax-type crude separated from

*Petroleum engineering staff of Texas Petroleum Co., Caracas.

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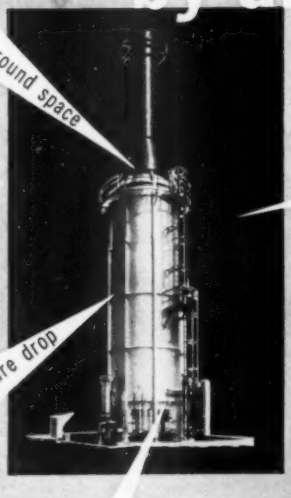

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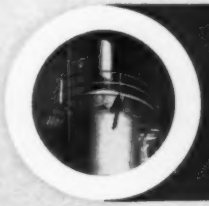

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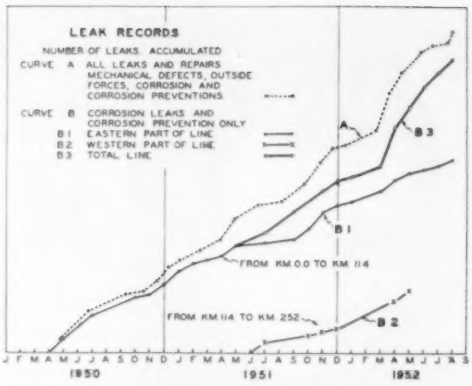

LEAK RECORDS
NUMBER OF LEAKS ACCUMULATED
CURVE A ALL LEAKS AND REPAIRS MECHANICAL DEFECTS, OUTSIDE FORCES, CORROSION AND CORROSION PREVENTIONS
CURVE B CORROSION LEAKS AND CORROSION PREVENTION ONLY
B1 EASTERN PART OF LINE
B2 WESTERN PART OF LINE
B3 TOTAL LINE
A
B3
B1
FROM KM 0.0 TO KM 114
FROM KM 114 TO KM 252
B2
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S
1950
1951
1952

Fig. 3. Leak records for Las Mercedes pipe line.

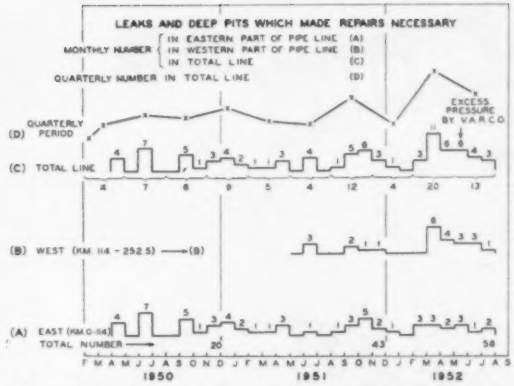

LEAKS AND DEEP PITS WHICH MADE REPAIRS NECESSARY
MONTHLY NUMBER IN EASTERN PART OF PIPE LINE (A)
IN WESTERN PART OF PIPE LINE (B)
IN TOTAL LINE (C)
QUARTERLY NUMBER IN TOTAL LINE (D)
EXCESS PRESSURE BY V.A.R.C.O.
(D) QUARTERLY PERIOD
(C) TOTAL LINE
4 7 5 3 4 2 3 4 5 6 3 3 6 6 4 3
4 7 8 9 5 4 12 4 20 13
(B) WEST (KM 114 - 252.5) ⟶ (B)
3 2 1 6 4 3 3 1
(A) EAST (KM 0-114)
4 7 5 3 4 2 1 3 1 3 5 2 3 3 2 3 3
TOTAL NUMBER ⟶
20
43
58
F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S
1950
1951
1952

Fig. 5. Leaks and deep pits in the line which made repairs necessary.

the others which are of the mixed-base type.

The terminal and sea line . . . The crude oil is received at the Pamatacual terminal situated about 7 miles east of Puerto La Cruz. Storage consists of five 131,500-bbl. tanks with floating roof, all at a level between 290 and 320 ft. above sea. The tanks are some 3,500 ft. from the loading berth and are tied into a 22-in. manifold. The manifold is connected to a 20-in. loading line, which leads to the 16-in. sea line. The sea line runs about 650 ft. from shore in shallow water, but the rest of its total length of 1,600 ft. sinks down quite rapidly to a total depth of about 85 ft. under sea level.

The end of the sea line which is anchored tightly to a rock bottom is connected to a 10-in. flexible, armored submarine rubber hose, the end of which is kept afloat by a buoy. When a tanker is to be loaded, the hose is hoisted aboard and coupled to the manifold of the ship. The loading of the crude from the storage tanks into the tankers is done by gravity.*

Some Investment Figures

The main line cost more than 8 million dollars. Crude-oil loading lines and fittings at terminal including the sea line: $250,000; crude-oil lines and fittings around Guasimito, $160,000; gathering lines, $56,000.

The above figures are approximate only and are mentioned here merely to demonstrate the high investment which makes it definitely worth while to protect it against early destruction by corrosion.

Corrosion History

From July 1948 to July 1950 there were no leaks in the line which could be positively traced back to corrosion. Those breaks which occurred were caused by outside forces or by defective welds.

*For more details about pipe line and terminal installations, see: D. H. Stormont, Petroleo Interamericano, November 1948, page 57.

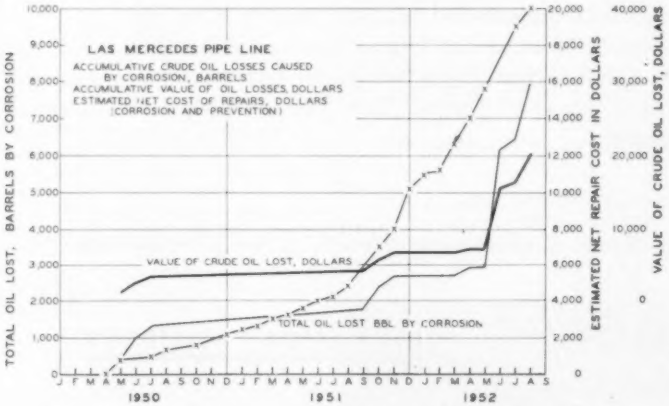

LAS MERCEDES PIPE LINE
ACCUMULATIVE CRUDE OIL LOSSES CAUSED BY CORROSION, BARRELS
ACCUMULATIVE VALUE OF OIL LOSSES, DOLLARS
ESTIMATED NET COST OF REPAIRS, DOLLARS (CORROSION AND PREVENTION)
TOTAL OIL LOST, BARRELS BY CORROSION
ESTIMATED NET REPAIR COST IN DOLLARS
VALUE OF CRUDE OIL LOST, DOLLARS
VALUE OF CRUDE OIL LOST, DOLLARS
TOTAL OIL LOST BBL BY CORROSION
10,000 9,000 8,000 7,000 6,000 5,000 4,000 3,000 2,000 1,000 0
20,000 18,000 16,000 14,000 12,000 10,000 8,000 6,000 4,000 2,000 0
40,000 30,000 20,000 10,000 0
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S
1950
1951
1952

Fig. 4. Amount and value of crude oil lost through leaks in the pipe line.

This changed rapidly, and 14 major repair jobs were necessary between the end of July 1950, and the middle of March 1951. The total number of leaks and repairs already amounted to 30, the majority of which were evidently caused by corrosion. (Fig. 3). More than 1,500 bbl. of crude oil was reportedly lost, representing a value of about $2,800. The cost of the repairs—with no overhead included—to that date was estimated at $3,000, hence amounting to a total of about $5,800 for lost crude and repair cost. (Fig. 4).

No leaks had developed in the loading line until March 1951.

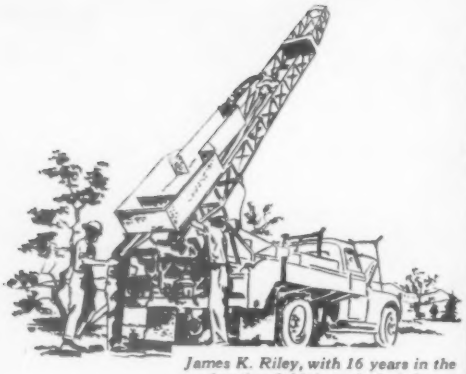
The first leak in the sea line developed in September 1950. From that time to the middle of March 1951, there were seven leaks noticed in the sea line. Most leaks occurred in welds. If leaks occur in waters deeper than 5 ft., the service of a diver is necessary and repairs become complicated and expensive.

As soon as the number of the corrosion leaks increased, the pipe-line department recognized the danger and began to raise the line and to put it on concrete blocks. This was done at the most dangerous spots at first, and then gradually, from east to west.

Corrosion Surveys

General . . . Because of the number of leaks developed up to the beginning of 1951, and the fact that the pipe-line engineers reported serious corrosive attack at many distant places along the line, a special survey of the line with emphasis on the corrosion problem seemed advisable.

The main purpose of this first survey was to define more clearly the dangerous sections, to find hot spots and then to classify, on the basis of all available data, the work to be done to mitigate corrosion, according to its urgency.



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The main pipe line was inspected by driving along it wherever possible, starting out from the Pamatacual terminal. The sea line was visually inspected as far as visible under water without using special illumination.

Previous observations by the pipeline engineers and personal experience were taken as a first guidance to select the indvidual stations for inspection and measuring; also the position of leaks already found and the places where bad corrosion had made repair jobs necessary. This is why most stations were put in the section between Pamatacual and the Unare River; the section from there to the Tamanaco River was still fairly well covered by stations with the exception of the short cut between Km. 140.4 and 154.2 (87.2 to 95.8 miles). In this section, where the pipe line turns off quite far from the Guarico road, the survey was limited to only three stations. This was because of difficult accessibility and wet ground.

In the section between the Tamanaco River and Km. 228 (141.7 miles), (west of Chaguaramos) only a few stations were taken during the first survey, but a considerable number during the second survey in September 1952.

Observations on erosion . . . The main line has relatively few and very gradual side bends. The overbends and sags were made so that the line conformed very closely to the lay of the land. Due to the movement of the crawler tractors while the pipe was laid, followed by heavy tropical rains, there was erosion along the line and measures had to be and still will be taken to stop it. As the earth is washed from quite a few places under the line, there is the danger that the line may lean sideways. The pipe-line engineers agreed at the time of the first survey that the line must be clamped down at several places. In less-severe cases the erosion may be stopped by putting retarding baffle boards underneath, in rectangular position to the direction of the line.

Electrical measurements . . . During the primary survey electrical measurements were taken at more than 70 places along the pipe line; these places were selected in accordance with the two prime objects of this survey: (1) to find a general trend to define more clearly and to classify the corrosive areas, and to determine "hot spots" where repair is urgent or where special protection is needed.

For the first objective measurements were taken at more or less regular intervals, in particular where changes of conditions could be expected. For the second objective the measurements

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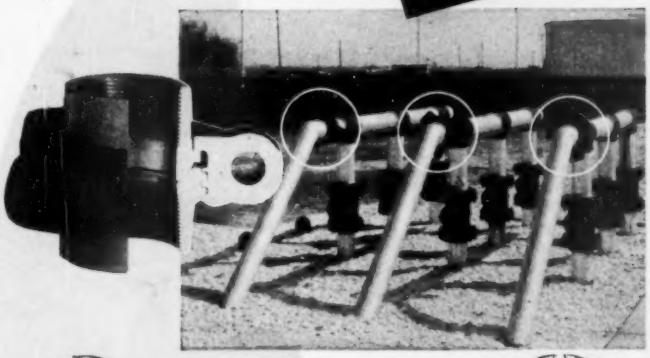

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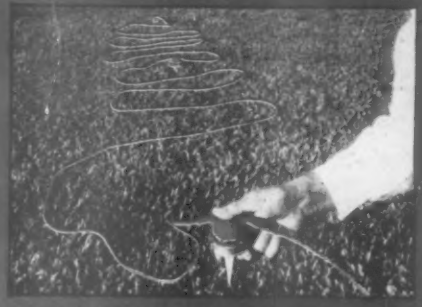

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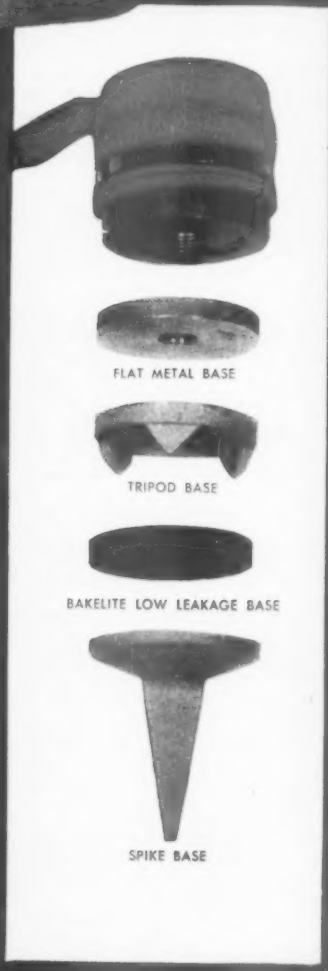

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TABLE 1

Resistance of line pipe alloy assumed to be 215.3 micro-ohms per pound-foot.

O.D. in.	Wall in.	Wgt./ft. lb.	Mv/100 ft.	Mv/amp/100 ft.
16	.500	82.77	261	.261
16	.4375	72.72	297	.297
16	.375	62.58	346	.346
16	.250	42.05	507	.5132

were taken mostly on both sides of road and river crossings, of swamp areas and of ravines.

During the second survey electrical measurements were taken at 70 places. This time the objective was—in the eastern, already blocked-up part of the line—to determine the effect of the galvanic anodes and—in the western part—to supplement the knowledge obtained during the first survey and also to measure the effect of galvantic anodes on the line still in contact with the soil.

Determination of current . . . The IR drop (E) was determined by means of a multicombination meter, generally over a 100-ft. span, between two special clamps fastened tightly to the metal body of the pipe line. The pipe weights and the corresponding resistance in millivolts per ampere on a 100-ft. span are given in Table 1.

Measurement of pipe-to-soil potential . . . The pipe-to-soil potential was determined by using the high-resistance potentiometer circuit of the aforementioned instrument. A copper-copper sulfate half cell was used as the contact with the previously moistened soil.

Measurements of the resistance of the wire and of the contacts showed that corrosion for the potential drop in the external circuit was considerably less than other sources of error so that no correction was applied.

The potential drop through the copper-copper sulfate half cell was checked at the beginning and the end of the survey and found to be relatively constant, namely around 0.30 volts. The cell used during the survey was compared with another one not used, and only a very small difference between the potential drop of the two cells was encountered.

Measurement of soil resistance . . . During the first survey a Bidell ground meter was used. The four brass pins used as contact electrodes were 4 in. long, and 12.8 in. apart from each other. During the second survey an instrument with a single probe, 4 in. in length, was used. The resistance was usually determined at first with the soil in its actual state and then, at the same place, after the soil had been wetted at the point or points of contact. The difference was always considerable. Differences up to several thousand ohms were found between the resistance of dry and wet soil samples.

Condensed results of first survey . . . The following general results were obtained from measurements taken and observations made during the first survey of the pipe line: (1) The engineers were put in a much better position to define the extent of potential corrosive areas; (2) in many cases a more reliable foundation was obtained for the recommendation of preventive measures; (3) fifty specific recommendations were made to mitigate or prevent corrosion; (4) these recommendations could be classified according to their urgency; this way the cost of pipe-line maintenance can be kept lower without taking chances by postponing certain preventive measures.

Period from June 1951 to April 1952 . . . As permitted by the weather conditions and, whenever possible, in the order of their urgency, all the recom-

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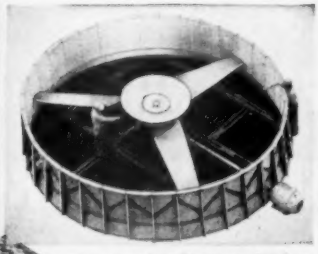

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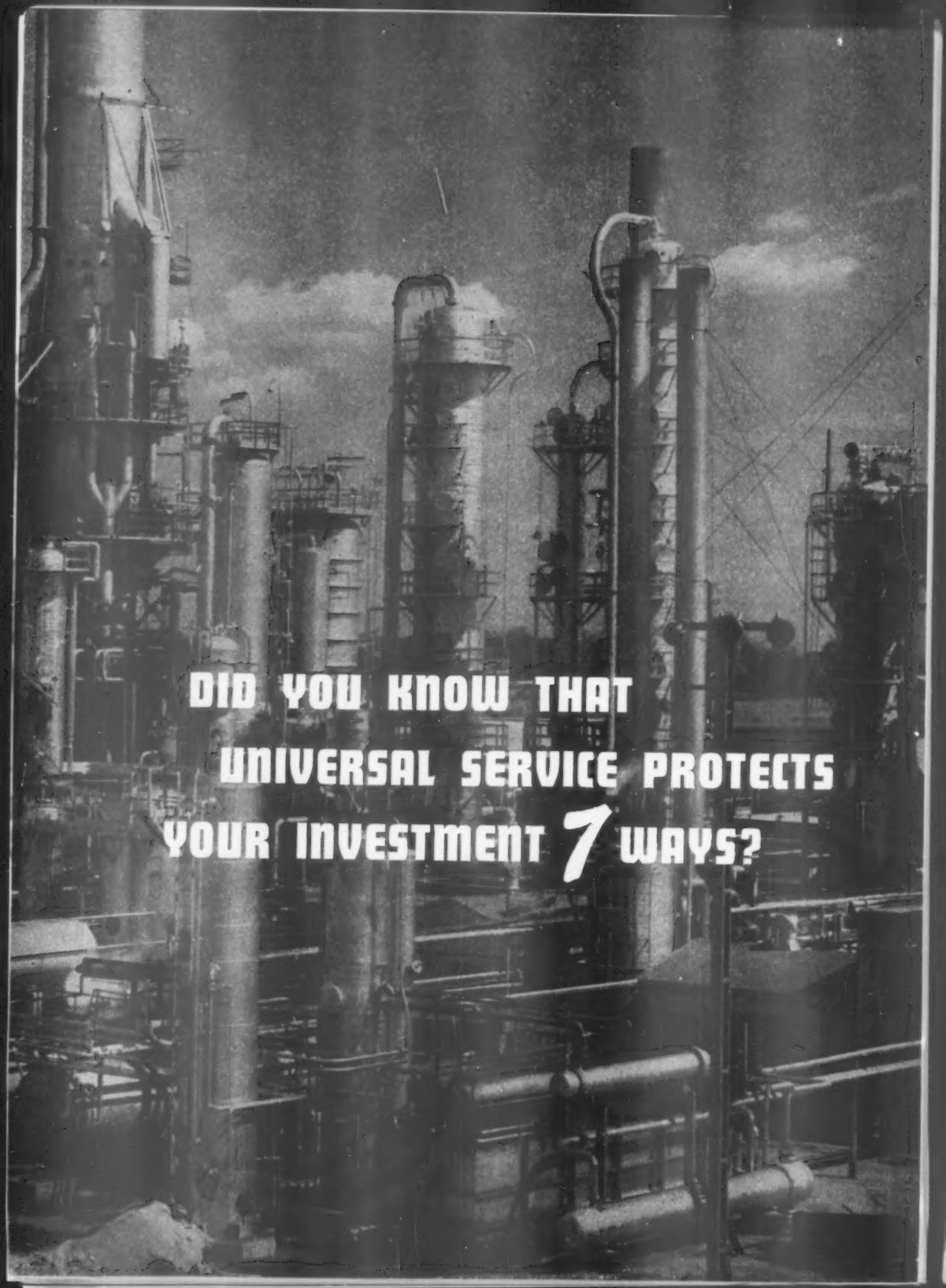
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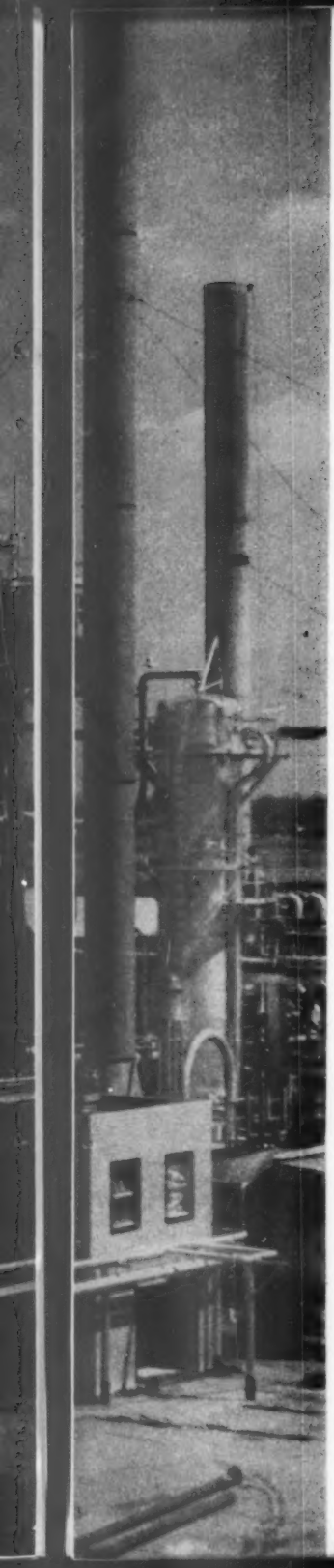

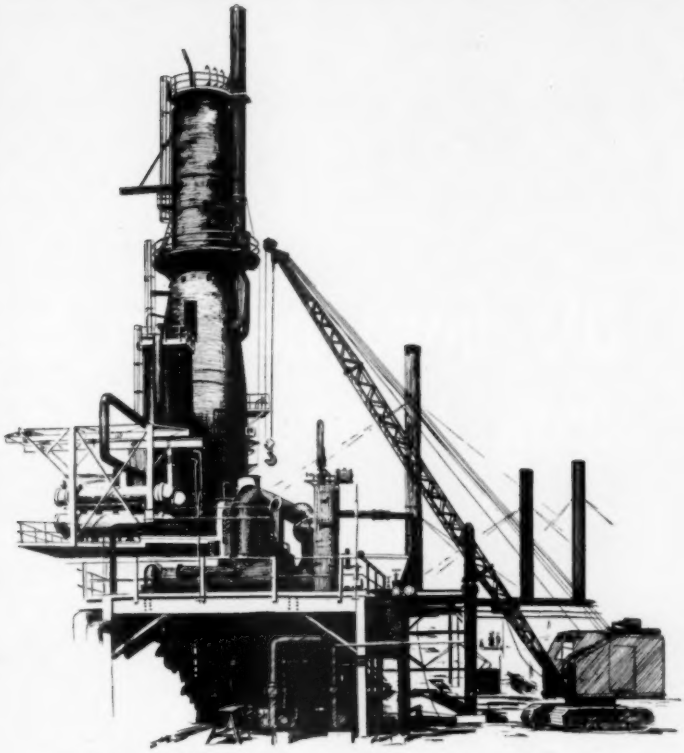

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mendations made by the corrosion engineer after the first survey were carried out.

At the beginning of October 1951, about 49 km. (30.4 miles) of the main pipe line was laid on supports of 4-in. Victaulic pipes and about 79.2 km. (49.4 miles) on concrete blocks. (Fig. 2). The pipe supports were found insufficient in many places where the ground had become soft during the rainy season. Therefore, they were gradually replaced by concrete blocks. All but the absolutely necessary crossings were eliminated. The remaining road crossings and the river crossings were protected by magnesium anodes. Finally, the section of the pipe line on concrete blocks was extended to Km. 162.

No protection was given to the sea line except the small amount of current drawn by the Mg anode buried right at the shore. However, only very few leaks occurred and the leak rate was markedly decreasing in 1952.

Second corrosion survey . . . The section of the pipe line from the seashore to Km. 114 is arbitrarily called the eastern part, and from that point to the pump station at Guasimito, the western part. The corrosive tendencies of the soil, on the broad average, are noticeably greater in the eastern than in the western section. Low places, lagoons, ravines, river crossings, however, are equally dangerous in both sections.

At the end of June 1952, a total of 74 repair jobs had become necessary—54 in the eastern and 20 in the western part of the pipe line. (Fig. 5). At that date the crude oil lost amounted to the volume of about 6,000 bbl., representing a value of more than $21,000.

The cost of repair for leaks and deep pits caused by corrosion only amounted to $20,000 and with the aforementioned $21,000 for oil losses, it adds up to $41,000. (Fig. 4).

The expenses for other preventive measures against corrosion, though also considerable, are not included in the above sum.

The second survey of the line was scheduled for the end of the rainy summer season of 1952, and it was actually carried out toward the end of August. Its main objectives were to check the performance of the magnesium anodes which had been installed between November 1951 and April 1952, and to find the most advisable method of protecting the section of the pipe line west of Km. 162; considering thereby the technical and the financial viewpoint. From experience it was known that cost and installation of one 32-lb. magnesium anode amounted to about $40, and that the raising of the line and putting it on concrete blocks (10 by 26 by 36 in.) cost approximately $1,350 to $1,400 per mile.

As there was still plenty of rainfall when the survey was made, the pickup car used had to stay on the road always and, therefore, only those sections of pipe line which run fairly close to the road could be inspected. The Guarico roads near Los Clarines were impassable for several days. That is why no stations could be located in this neighborhood.

Eastern section of the line (Km. 0.0 to 114) . . . This entire section is raised on concrete blocks and H-frames, with the exception of road and river crossings.

All anodes were checked between the sea shore and the Unare River (Km. 87), and the pipe-to-soil potential and the IR drop in the pipe line were measured in the neighborhood of the anodes.

The pipe-to-soil potential has become more negative at all places compared with corresponding values of the first survey. The increase of the potential at the individual places is irregular, but it shows a tendency to be inversely proportional to the soil resistivity. In other word, where the soil resistivity is high,

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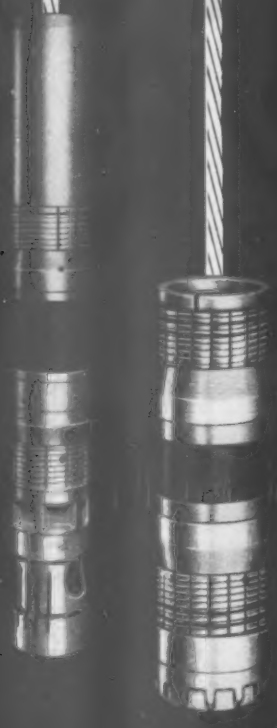

Baker Retainer Production Packer

Baker Casing Bridge Plug

THE BEST PROOF of these savings is the increased number of wire line setting jobs by oil operators everywhere. For example, out of the total number of Baker Casing Bridge Plugs set during the year 1951, 71% were run on wire lines.

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Consider, too how wire line setting helps you to avert premature setting of either device, caused by junk or other debris in the hole. And don't overlook the fact that in many instances both the gun-

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perforating operation and the wire line setting of a Baker Bridge Plug, or a Baker Production Packer can be performed from a *single set-up* by the wire line service organization you select, with definite *savings in time and money.*

Consider also, the advantages of accurate correlated measurements:

(a) wire line measurement while logging the well;

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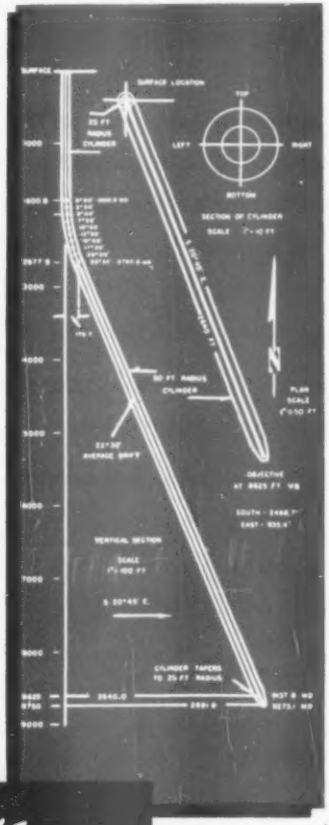

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the increase is small; where the resistivity is low, in particular near the river crossing, the potential is raised considerably.

One exception is Station No. 1 right at the sea shore where only a small increase was found. This, however, could be explained by the very high conductivity of the sea line extending west from this measuring point. The average increase in this section of the pipe line was found to be —.15 volt; near the river crossings, however, the potential was depressed to —.90 volt, which should give ample protection to the buried sections of the pipe line.

It was concluded that the magnesium anodes should give sufficient protection to the road and river crossings, although a high percentage of their effects is diverted toward the raised part of line on both sides of each crossing.

Western section of line . . . A considerable part of this section runs at a fairly large distance off the paved road and were, therefore, inaccessible because of the prevailing rainy season. Therefore, the section of the pipe line from Km. 190 to 228 was selected as representative. Electrical measurements were taken at relatively short intervals and the places where magnesium anodes were installed were particularly examined.

The line in this section is lying on the ground with the exception of the part between Km. 204 and 206 where it is raised on concrete blocks, and a few short sections placed on 4-in. Victaulic pipe. The potential in this section has become depressed from an average of —.15 to —.38 volt by means of fourteen 32-lb. Mg. anodes, which were installed in the beginning of 1952.

It is possible that these anodes helped to depress the negative potential at several points, in particular, around Km. 204, 219, and 227. It is difficult to detect, however, what portion of the increase of the pipe-to-soil potential along the whole test section is due to the spreading of the current which leaves the anodes, or due to seasonal changes. It is certain, however, that the seasonal changes have a noticeable influence on the increase of the potential. This is mainly based upon the fact that there is a much higher resistance along the line at the end of the dry season; i.e., the time the first survey had been made.

Unfortunately, too few measurements were taken in this section during first survey to obtain a good comparison. During the second survey it was found that the current flow in the line shows distinctly that there are several complete circuits with cathodic and anodic areas along the test section. The rivers Tucupido, Manapire, Otocuao, and several creeks carry water only during the rainy season, and it can be clearly observed that there is an anodic area close to those thoroughly wetted places.

Recommendations . . . In order to obtain a clearer picture, it seems advisable to install more magnesium anodes and repeat the survey after about 10 weeks' time. At this time, around the middle of December, the rainy season will have come to an end. Based on actual observations and on the data published in the literature, a provisional spacing of 1,500 ft. is suggested along the test section. The results of this future survey will enable us to distinguish between seasonal influences and the changes brought about by the magnesium anodes.

Although the blocking-up of the line in its entire length is undoubtedly the safest way of protection against corrosion, the suggested test with magnesium anodes is certainly justified because of the findings during the second survey and because of the fact that the protection by means of magnesium anodes when spaced at 1,500 ft. (460 m.) distance, would cost only 10-12 per cent of the expenses for blocking-up.

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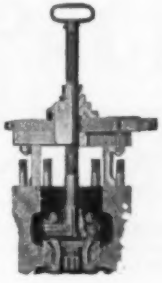

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HEAT-LOSS compensation in oil pipe lines by the use of mineral-insulated copper-sheathed cables is practical. Satisfactory operation will result from a properly designed and installed system, with long life and extremely low maintenance cost.

The capital cost ratio of electrical pipe tracing for heat-loss compensation when considered against equivalent steam methods, can be stated approximately as follows:

Electrical pipe tracing : Steam tracing.—Ratio 1 : 2.

Electrical pipe tracing : Steam jacketing.—Ratio 1 : 3.

In general, the running cost of an electrical heating system is greater than that of a steam system, when viewed purely from the cost per thermal unit consumed. It is claimed that the cost of the electrical heating system described is considerably below that of steam, because of its complete flexibility together with greatly reduced maintenance.

The maintenance required on the actual heating cable installation is negligible, provided due care is taken during design and installation, and the whole system is properly waterproofed. The tendency will of course be to dry out any moisture present, and corrosion should consequently be reduced to a minimum.

Two methods . . . Electric heating of pipe lines may be carried out by two methods:

1. Direct heating is achieved by passing a heavy current through the pipe walls. The heating effect is obtained from the I²R power loss and eddy current loss.

Advantages of this method are considered heavily outweighed by the disadvantages.

2. Electrical pipe tracing is achieved in a similar manner to steam tracing, but electrical heating cables of the mineral-insulated metal-sheathed type are used. The principal advantages of this system of heating are that:

(a) It is inherently flameproof.

(b) The heating system can be designed without reference to site.

(c) It can be designed for operation from the normal low or medium voltage supply system.

(d) Concentration of heating at strategic points may be easily accomplished.

The principle disadvantages of the system are:

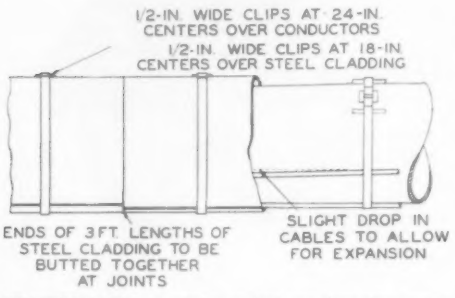
(e) Possible corrosion of the copper sheath due to atmospheric conditions.

(f) Necessity for breaking the cables when pipe is dismantled for maintenance or repair.

Running costs are greater than for steam systems, but this is offset by the way the electrical system lends itself to automatic control, and the considerable saving in maintenace costs.

Electric tracing . . . The usual method of electrically heating a fuel-oil line is to install electrical tracing on the pipe, automatically controlled by means of a thermostat at the receiving end of the pipe line. The oil is usually preheated before entering the pipe line to a temperature which allows for any loss of heat during the transit period. The electrical system, therefore, is not called upon to operate unless the temperature at the receiving end falls below the desired value due to cessation of pumping, a drop in ambient temperature, or from other causes.

With any of the above conditions the electrical heating is automatically switched on by the thermostat control, and the pipe and contents are maintained at the desired temperature.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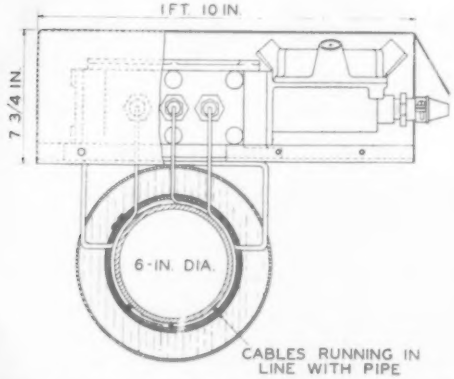
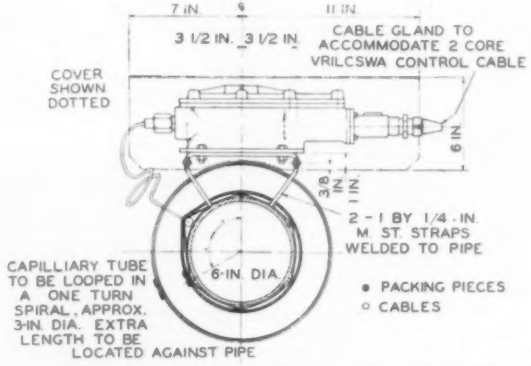
ENDS OF 3FT. LENGTHS OF STEEL CLADDING TO BE BUTTED TOGETHER AT JOINTS
SLIGHT DROP IN CABLES TO ALLOW FOR EXPANSION

HEATING-CABLE installation method uses three-phase system with three single-core cables laid longitudinally along the pipe. Fig. 1.



CABLE-TERMINATING arrangement comprises standard flameproof junction box with required incoming and outgoing cable glands. Fig. 2.


7 IN.
11 IN.
3 1/2 IN.
3 1/2 IN.
CABLE GLAND TO ACCOMMODATE 2 CORE VRILCSWA CONTROL CABLE
COVER SHOWN DOTTED
6 IN.
3/8 IN.
1 IN.
2 - 1 BY 1/4 - IN. M. ST. STRAPS WELDED TO PIPE
CAPILLIARY TUBE TO BE LOOPED IN A ONE TURN SPIRAL, APPROX. 3-IN. DIA. EXTRA LENGTH TO BE LOCATED AGAINST PIPE
6-IN. DIA.
• PACKING PIECES
○ CABLES

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The mineral-insulated cable employed for pipe heating comprises a central conductor or conductors, surrounded by an insulating medium of compressed magnesium oxide, enclosed in a metal sheath. The standard range of cables is manufactured with copper conductors and sheaths, and have a maximum working temperature of 250° C. These have proved adequate for most heat-loss-compensation schemes.

Electrical Pipe Tracing

From a knowledge of the normal operating temperature of the pipe line and the minimum expected ambient temperature, the normal heat loss from the pipe line can be estimated under still-air conditions, with the pipe line insulated with any one of the many heat-insulating materials available.

From a geographical study of the pipe-line route relative to the prevailing atmospheric elements, it is possible to estimate the allowance that should be made for the increased heat loss.

The maximum heat loss in thermal units when converted to equivalent electrical units in watts will be the power input required.

Installation Details

The most practical way of installing the resistance heating cables has been found to be as generally illustrated in Fig. 1. This shows a three-phase system with three single core cables laid longitudinally along the pipe line, one laid along the bottom of the pipe and the other two spaced approximately 60° on either side. The cables are held in position by circumferential clamping bands spaced about every 2 ft.

Allowance for unequal expansion between pipe and cable is made by laying the cable with a slight sag between the clamping bands. The pipe, complete with cables, is then wrapped with a light steel sheeting, with spacers fitted between pipe and sheeting around the top circumference. An air space approximately equal to the diameter of the cable is thereby insured between the pipe surface and the inner surface of the sheeting. The air space provides for a good distribution of heat from the cables, and avoids the production of hot local areas.

The heating system thus becomes basically one of electrically heated hot-air jacketing, although some of the heat transfer will of course be by conduction from cables to pipe and sheeting. The steel sheeting should be protected from corrosion by using any of the standard protective finishes, and the assembly then heat insulated in the normal manner and waterproofed over all.

An alternative method of providing an air space is by the use of overlapped steel reinforcing mesh which may be more economical. A mesh of about 1½ by 1½ in. with ¾-in. diameter steel wire is thought most suitable, laid with the innermost wire circumferentially. This allows the heat-insulating material, usually of the preformed type, to crush into the top wire when clamped into position by the over-all banding.

The arrangement for terminating the heating cables and incoming feeder cable is shown in Fig. 2, and comprises a standard flameproof junction box with incoming and outgoing cable glands to suit the desired arrangement.

The remote ends of a three-phase heating cable system are normally star connected, using a standard flameproof junction box fitted with internal terminals.

For the purpose of maintenance and testing it is advisable to insert flameproof junction boxes at suitable intervals along the cable runs. These are usually mounted so that the covers are easily accessible, without the necessity for removal of heat insulating material.

Electrical Control System

The incoming supply to each section of the heating system can be controlled in a variety of ways. The most suitable has been found to be by automatic contactor fitted with earth leakage protection. Temperature control is

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obtained by the use of thermostats which operate the above contactors. A typical thermostat installation is shown in Fig. 3.

A number of heat-loss-compensating systems have been designed for operation in the United Kingdom and on the continent.

One system already commissioned comprises 3,400 ft. of 6-in.-diameter pipe line at an operating temperature of 68° C. The average power input at 380 volts 3 phase 50 cycles is 30 watts per foot. The heating system is divided into two sections of approximately equal length.

From recorded results it is estimated that with an atmospheric temperature of —6° C. the pipe-line temperature would not fall below 45° C.

Other installations at present under construction in the United Kingdom include heating systems designed to maintain temperatures varying between 70° and 310° F. with a minimum ambient temperature of 32° F. The individual sections of the heating systems vary in length between 500 and 1,500 ft.

Single-core copper-sheathed mineral-insulated cables have so far been used exclusively in all United Kingdom installations. Conductor sizes include 0.003 and 0.0045 sq. in. alloy for the short sections at low temperatures, and from 0.001 to 0.007 sq. in. copper for the long sections at high temperatures.

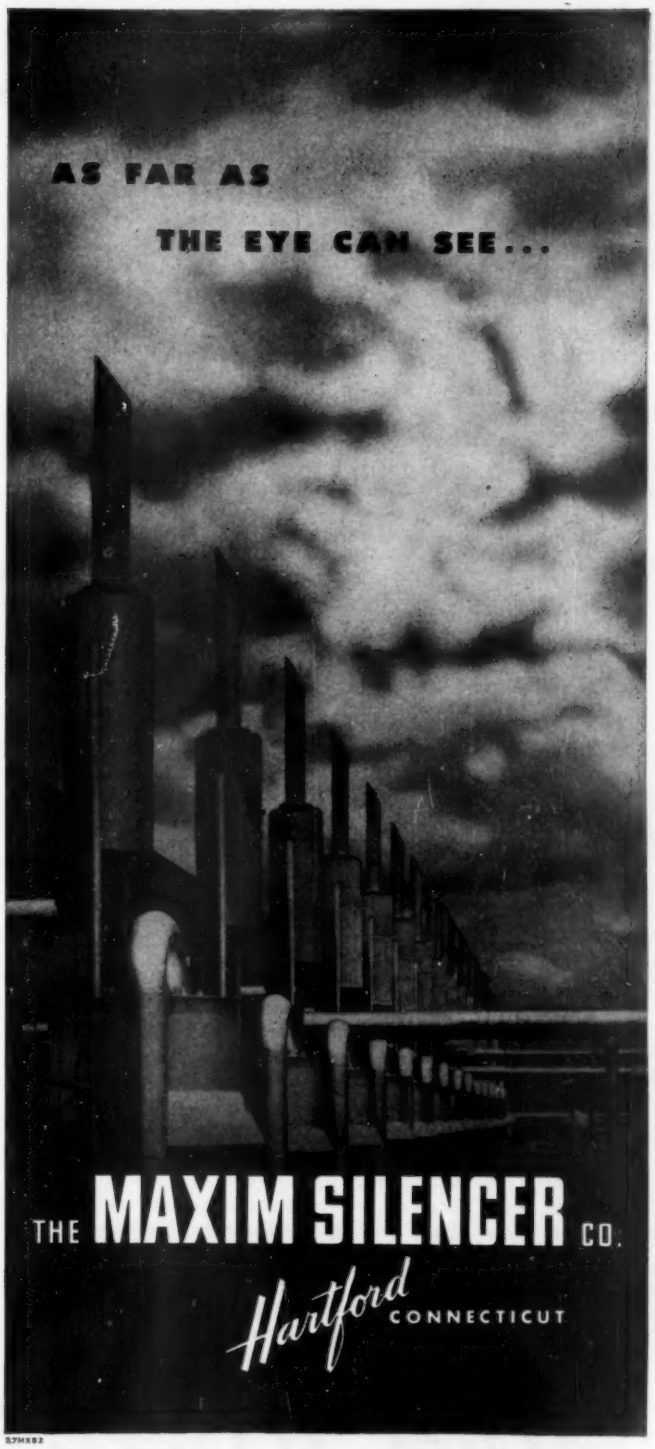
As far as possible the systems have been designed for three-phase operation rather than single phase. By this means a balanced load is achieved, and the necessity for neutral return cabling is avoided.

Pipe-Line Heating

Pipe-line heating involves the solution to a number of difficulties, which include the provision of a high rate of heat input in order to achieve the desired result in a given time. The application of heating cables external to the pipe surface would give rise to high temperatures and additional heat-insulating materials, which would be unnecessary at the normal operating temperature of the pipe line.

In order to avoid some of the disadvantages of this method, investigations have been turned to the system of running heating cables internally. This system has the advantage of heat transfer through the pipe-line contents in an outward radial direction. It avoids the necessity of high-temperature heat-insulating material, and the heat input is applied directly to the pipe-line contents.

The risk of cable-sheath corrosion due to certain adverse elements being present in the fluid in the line makes the choice of cable sheath material of importance.



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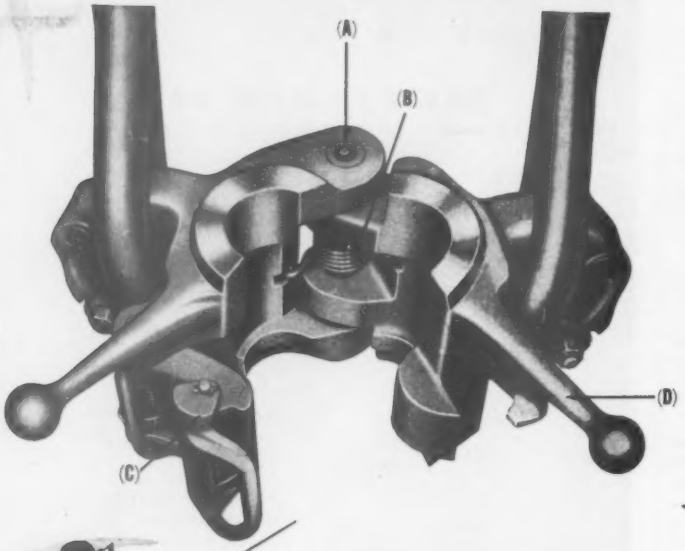


(A) This fitting (safely recessed in the hinge pin) permits proper lubrication to ensure easy opening and closing of elevator.

(B) This spring opens the elevator and forces it off and away from the pipe.

(C) The safety lock closes automatically with the latch; and one easy motion opens both lock and latch.

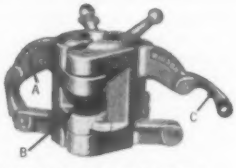
(D) Guards on handle protect hands from injury against the links.

The *exclusive* features shown above are sufficient to make the Web Wilson "Balanced" Center Latch Elevator the WORLD'S BEST—and the choice of fast-moving, safety-minded crews—but there are **OTHER IMPORTANT FEATURES!** Remember that these "Balanced" elevators are made from Manganese-Molybdenum steel, properly heat treated—all pipe contacting surfaces are flame hardened to wear a long, long time—and see other advantages at right.

FOR ALL TYPES AND SIZES OF DRILL PIPE. Web Wilson "Balanced" Center Latch Elevators are available for Regular and External Upset "Collar Type" drill pipe, and also for "Bottleneck" (18-degree taper) drill pipe. Made in 12 sizes to handle drill pipe and tubing from 1¼" to 7".

YOUR supply store has Web Wilson "Balanced" Center Latch Elevators in stock—or can get one for you—pronto!

The slanted hinge pin, which provides automatic closing, is clearly seen above.



A–Rugged Link Arms fit links perfectly.
B–This spring opens the elevator and forces it off and away from the pipe.
C–Link Arms are easily operated, but are securely locked in place.

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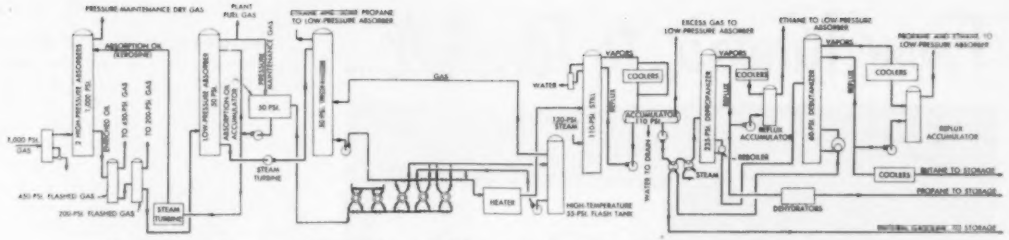

Flow diagram of gas-processing operation at Chile's new plant at Cerro Manantiales in Tierra del Fuego area.

E.N.A.P. Puts Its First Natural-Gasoline Plant On Stream at Spring Hill, Chile

Topping plant has also been built to supply motor-fuel demand in Province of Magallanes

THE Empresa Nacional del Petroleo, an operating organization which handles exploration, production, and refining operations in Chile, has recently put on stream its first natural-gasoline plant at Cerro Manantiales (Spring Hill), in the Tierra del Fuego area (Magallanes Province).

Construction of the plant was started in May 1951. Delays were due to slow delivery of electrical equipment imported from the United States.

The plant was designed and built under the supervision of Hudson Engineering Co., Houston.

Design features . . . The plant has a design capacity for processing and handling 30,000 M.c.f. per day to be returned to the producing formation, and for stabilizing 6,000 bbl. of crude per day. In addition, a topping plant has been built to supply the motor-fuel demand in the Province of Magallanes, as well as the local demand for kerosine and diesel fuel.

This gathering system has a total of over 30 miles of lines. Part of the stabilized crude goes to feed the topping plant; the remainder is sent to the Clarencia shipping terminal for shipment to Uruguay.

The plant is of a very compact design, but operators have easy access to all parts of the installation.

The main instrument-control panel is located in the pump house which in turn is located between the two processing sections. On the north side of the pump house are the topping columns, the depropanizer, debutanizer, still, and raw-product accumulator. South of the pump house are located the high and low-pressure absorbers, the crude stabilizer, the depropanizer tower, the high-temperature rich-oil flash drum, and the heat exchangers in one line. In addition, there are two groups of scrubbers and flash drums, located between the process area and the valve and compressor yard.

1. **Absorption and gas compression.**—Gas from both oil and gas fields enters the plant at 1,000, 200, and 60 psi. In accordance with original estimates, the amounts are as follows: 20,000 M.c.f. at 1,000 psi., 9,500 M.c.f. at 200 psi., and 500 M.c.f. at 60 psi.

The compressor plant is made up of five 660-hp. units. Each has four compressor cylinders. Low-pressure gas from the field, at 200 psi., enters a separator and is then compressed in the first cylinder to 400 and 450 psi. It then goes through an intercooler and a second separator, and is compressed in the second cylinder to 1,000 psi. The gas passes through a second intercooler and enters the high-pressure absorbers, together with field gas at 1,000 psi. The dry gas goes into a third separator and then enters the dehydrators which are loaded with Fluorite. Then it enters the third compressor cylinder which brings it up to 1,800 psi. and is directly discharged into the fourth cylinder whose maximum working pressure is 3,500 psi.

Gas from the fourth compressor stage goes to feed the pressure-maintenance lines to injection wells. These lines are 4½-in. Schedule 80 pipe. For pulsation control, each cylinder has intake and discharge "bottles" (chambers) connected to the manifold in the valve yard located in front of the compressor building.

The products of the absorption plant, for full-capacity operation, are: propane, 500 bbl.; butane, 300 bbl.; natural gasoline, 200 bbl.

The gas-processing operation is shown on the accompanying flow sheet.

2. **The topping plant.**—This unit processes 700 bbl. per day. Average production: 160 to 200 bbl. gasoline, 160 to 200 bbl. diesel fuel, and 50 to 60 bbl. of kerosine.

3. **Stabilizer unit.**—The purpose of this unit is to deliver crude oil having a determined vapor pressure that meets the specifications given in sales contracts. The plant has been designed to process from 6,000 to 7,000 bbl. per day.

4. **Steam plant.**—The plant uses 40,000 lb. of steam per hour (at 340 psi.). This steam is supplied by six 150-hp. boilers, five of which are in continuous operation and one is used for standby service. The boiler draft leads into stacks which are 84 ft. high.

The guy lines of the stacks must be such that they will withstand the prevailing winds which, during the summer, reach 90 and 100 m.p.h. There are three steam systems. One which feeds the steam turbines and pumps as well as the dehydrator regeneration gas heater at 340 psi. One which is used for heating the reboilers and as stripping steam is at 120 psi. The third is at 10 psi. Steam from this system divides into two streams: the clean steam which goes directly into the boiler feed tank, and the oily steam which is used to heat the air-conditioning system. After passing through a condenser, this steam enters the chemical treaters and filters (flocculation

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tank) where it is stripped of its oil content.

5. **The electric plant.**—The electric energy requirements of both the plant and Spring Hill camp, are supplied by three 300-kw. generators. Two of these are in continuous service and the third one is used as a standby unit. The voltage used is 220-380, 50 cycles. The starters for the engines are located near the engines. The entire electric system is gas and explosionproof.

6. **The water-supply system.**—Feed water comes from 100-ft. wells producing from water-bearing sandstone. These wells produce by natural flow. The water contains a certain amount of hydrogen sulfide and is treated in a cascade aerator system, within the 2,000-bbl. regulator tank.

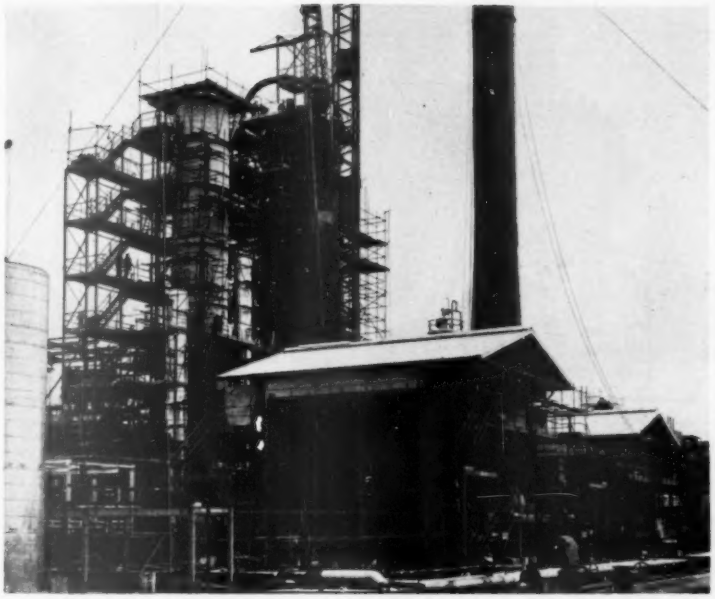
Two closed water-cooling systems are used. One is for cooling the electric-plant engines and the compressors, and the other for the process equipment. The pumps are electric-motor driven. The three-cell cooling tower was supplied by Hudson Engineering Co.

While the market for liquefied petroleum gas is being organized in Chile, part of the butane and propane production is returned to the field by means of a steam pump, for storing and future recovery. The plant is already equipped with facilities to supply bottled gas to consumers. In order to deliver gasoline with an adequate octane rating, the plant is equipped with a small leading unit. TEL is received at the plant in 30-gal. drums.

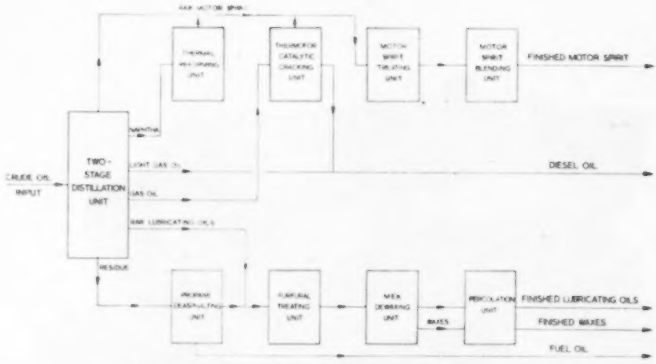
Russia Stepping Up Austrian Exporation

Russian oil authorities are increasing exploration work in their zone of Austria, and especially in the Baden district south of Vienna, according to reports from the Austrian capital. Considerable equipment for geophysical work and drilling is reported to have been assembled at Kottingbrunn, near Baden.

The Soviet Mineral Oil Administration is already producing fields in its zone of Austria at a rate now estimated at around 3,000,000 tons a year (about 60,000 bbl. daily). Some reports from Austria even estimate Russia's Austrian production at as high as 4,000,000 tons (about 80,000 bbl. daily). Much of the crude is coming from Matzen, Bockfliess, and Aderklaa. The Russians make every effort to keep their operations secret, but the information that has trickled through indicates they have had a greater success developing the Austrian fields than has been the case anywhere else in Communist Eastern Europe.



Vacuum Oil Co.'s new refinery at Coryton, Essex, England, showing distillation unit, with the heater units. The atmospheric distillation tower, painted white, is also seen.



Process scheme of Vacuum Oil Co.'s Coryton refinery.

Vacuum's New Lube Plant on Last Lap of Construction

The present building program, including the T.C.C. unit and the seven large service buildings, should be completed by the middle of 1953.

by Edward Symonds*

ONLY major British refinery to be designed primarily for lube-oil production, Coryton, 25 miles from London on the Essex side of the Thames estuary, will be on stream early in 1953. The new plant is being built by the Vacuum Oil Co.

The need to provide a sterling source of the stock oils used in large quantities in its oil and grease plants at Wandsworth (London) and Birkenhead (on the River Mersey) was a leading motive in the decision to build the refinery. Coryton has therefore been built, with dollar costs kept to a minimum. Apart from a small number of high-level technicians for construction and startup, manpower is all British.

Products . . . Coryton will produce, primarily for the British market, motor gasoline, diesel oil, heavy fuel oil, lube-stock oils, and waxes. With a throughput capacity of 17,700 bbl. daily, it is expected that the breakdown of main products will be of the following order:

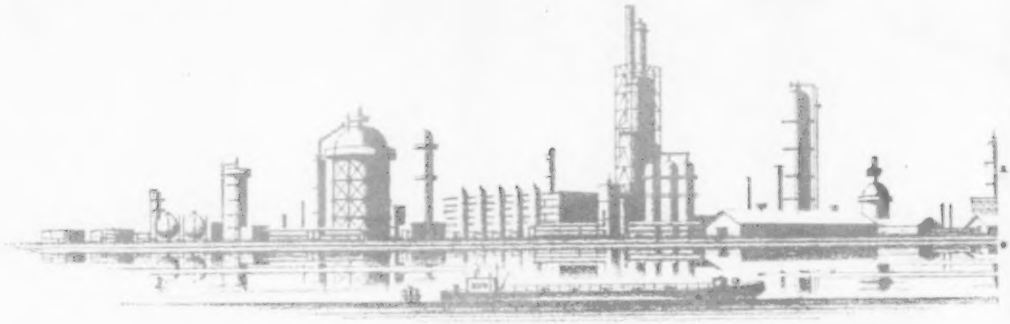
	Bbl. daily
Motor gasoline	6,450
Diesel oil	2,950
Heavy fuel oil	4,550
Lube-stock oils	1,900
Waxes	100
Refinery fuel, etc.	1,750
Total	17,700

Processing . . . Primary separation of crude oil into raw products will be carried out in a two-stage distillation unit. The remaining process units comprise eight main plants, as shown in the accompanying flow diagram. These units are the thermal reforming unit, the Thermofor catalytic cracking unit, the gasoline-treating unit, the ethyl-blending unit, the propane-deasphalting unit, the furfural solvent-refining unit, the methyl-ethyl-ketone solvent-dewaxing unit, and the Thermofor continuous percolation unit.

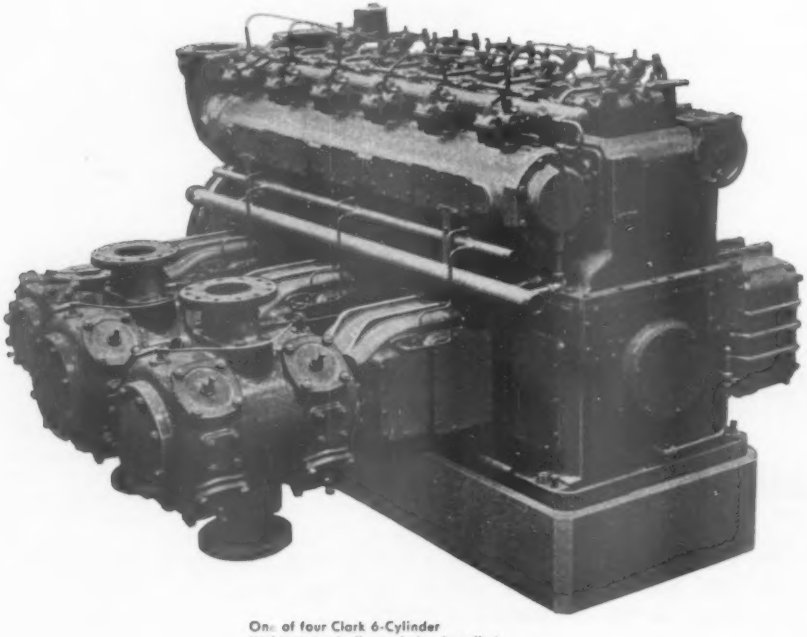
T.C.C. unit . . . This unit, built to the latest Socony-Vacuum designs, is the first of its kind in the United Kingdom. Apart from the plant of Socony-Vacuum Francaise at Frontignan, in southern France, it is also the first in Europe. Completion of the T.C.C. unit will allow Vacuum Oil Co. to market home-produced premium gasoline in the United Kingdom, and will therefore give the company a very strong card to play after the return of branded gasoline to the United Kingdom market on February 1, 1953. Under regulations issued at the beginning of the war, British motorists have been confined to gasolines of 70-72 octane (motor method) for the last 13 years.

The unit, expected to be on stream

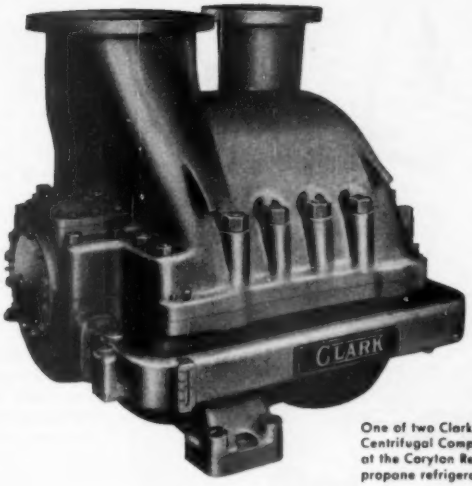
*Vacuum Oil Co., Ltd., London.



United Kingdom's first Thermofor Catalytic Cracking Plant, to use



One of four Clark 6-Cylinder "Midget Angles" now being installed at the Coryton Refinery for vapour recovery service.



One of two Clark No. 2, Five-Stage Centrifugal Compressors now being installed at the Coryton Refinery for propane refrigeration service.

CLARK COMPRESSORS

When the United Kingdom's first Air-Lift Thermofor Catalytic Cracking Plant of 10,000 barrels per day capacity goes on stream within the next few months, at Vacuum Oil Company's new Coryton Refinery, six Clark Compressors will go into service with it:

Four Clark 6-cylinder, gas-engine-driven, "Midget Angle" Compressors will be used in the vapour recovery section. Two Clark No. 2, five-stage, steam-turbine-driven Centrifugal Compressors will be used in propane refrigeration service in the M. E. K. dewaxing plant.

The Coryton installation is the second TCC unit in Europe built for Socony-Vacuum to use Clark "Midget Angles" in the vapour recovery section.

Compressor operators throughout the sterling areas of the world can now obtain British made Clark Compressors. These compressors are manufactured to Clark specifications and precision standards by:

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by mid-1953, will employ the liquid and vapor feed technique. The charge will consist of light and heavy gas oil, with small quantities of furfural extract, slack wax, and slop petrolatum.

Apart from cracked gasoline, the T.C.C. unit will produce distillate fuel oil and synthetic crude tower bottoms. Gas will be sent to the refinery gas system.

The catalyst used will be the patent bead type. Arrangements are being made for catalyst supply from a new plant in Germany, to supplement supplies from existing United States capacity.

Primary distillation . . . Products from the atmospheric stage of the distillation unit will be gasoline, naphtha, kerosine, light gas oil, and atmospheric bottoms. Atmospheric bottoms will be charged direct to the vacuum stage, which will produce heavy gas oil, three grades of lube stocks, and vacuum bottoms.

Gas and reformer tar from the thermal reforming unit will be fed into the refinery gas and fuel system. The reformed gasoline will be passed to the treating unit for caustic washing.

The gasoline-treating plant will have three units, one each for straightrun, thermal reformed, and catalytic cracked gasoline. As well as caustic washing, solutizer treatment and the addition of antioxidant inhibitor will be carried out by this unit.

Gasolines will be finally blended, leaded and dyed at the ethyl-blending unit.

Lube oils . . . Outstanding among the lube-oil units is the Thermofor continuous percolation plant. This is the first of its kind in the world.

The general principle involved in the continuous percolation unit is that a moving bed of adsorbent flows downward through a tower by the action of gravity. Raw lube oil is pumped countercurrently upward through this bed. The unit, in thus providing continuous percolation, contrasts sharply with the conventional static bed design.

The percolation unit will be divided into two sections, one for decolorizing lubes and the other for decolorizing wax. Base stocks will be charged to the lube section in successive batches. The wax section, on the other hand, is concerned with only one continuous charge.

In accordance with modern lube-oil manufacturing technique, undesirable elements in the raw lube oils will be extracted by solvent action in the furfural unit before dewaxing and percolation. There will be four charge

stocks. Three raw lube distillates will be fed from the distillation unit. Deasphalted oil, extracted by the use of liquid propane from vacuum bottoms in the deasphalting unit, will be the fourth charge stock.

With the exception of the deasphalting plant, all the lube units will run on "blocked operation," the four charge stocks being run successively. Enough intermediate tankage is therefore being provided to allow each stock to accumulate while others are being treated. Variations in operating conditions can allow for the satisfactory treatment of a considerable number of different grades of stock oil in the unit.

From the furfural unit, lube stocks will pass to the dewaxing unit. Dewaxed oils will pass directly from there to the percolation unit. Petrolatum will be rerun through the dewaxing unit to produce microwax.

Fuel, Storage, Transport

The refinery fuel system has been designed to give utmost economy. Gas produced by the various units will be burned in process unit heaters, with any excess spilling over to the boiler house. The remainder of fuel required by the boiler will be provided by fuel oil. Oil burned by the boilers will be essentially propane tar from the deasphalting unit.

An unusual feature of the storage arrangements is a gas sphere 35 ft. in diameter. All gas from the process units will pass through this sphere, which will provide surge time for the fuel-gas distribution system. It is expected that this sphere will cut losses to the flare to the minimum. To minimize evaporation loss, all gasoline storage tanks will be of the floating-roof type. Ultimate tankage capacity of the refinery will be nearly 400,000 tons.

Coryton has been designed to operate on Middle East crudes. These will be delivered by tanker to an enlarged jetty, which, with a minimum of 35 ft. of water at low tide, can accommodate the largest tankers likely to be built. The jetty has recently been equipped with a 24-in. pipe line, giving an unloading speed of 2,000 tons hourly.

Products will leave the refinery by road, rail, or water. In the case of the haul to the Birkenhead Works, a tanker of 1,600 dwt. tons is being specially built, the design allowing for the carriage of many separate lots of lube stock on a single voyage.

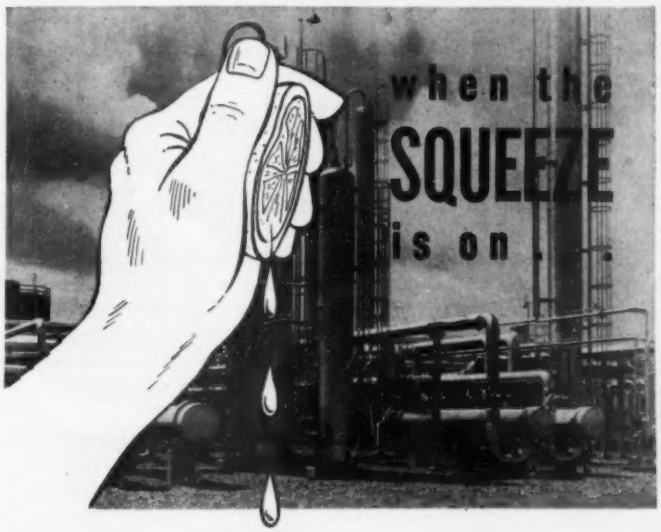
Utilities and Site Preparation

Cooling water supply presented a special problem at Coryton. The three 5,000-kilowatt turbogenerators of the power plant, together with the needs of the process units, called for the delivery of 45 million gallons of water daily. This water will be taken from the Thames.

At high tide, the whole of the site now being developed at Coryton lies well below the level of the Thames. Only the protection of the sea wall, built three centuries ago, prevents flooding. When Vacuum arrived, the site was largely waterlogged, and there were no foundations strong enough to support the weight of the tanks and towers of a modern refinery.

A pile-driving program with few parallels in any country had to be completed before construction work on the new refinery could begin. Some 12,250 piles were poured in place. In addition, 600 precast piles had to be driven to carry loads such as the T.C.C. unit, whose 270-ft. stature must resist the impact of the winds which sweep this part of Southeast England.

With the site thus securely underpinned, the rest of the construction project has been going quickly forward. The L-shaped ground plan allows for doubling of capacity in later building programs without reorganization of layouts.



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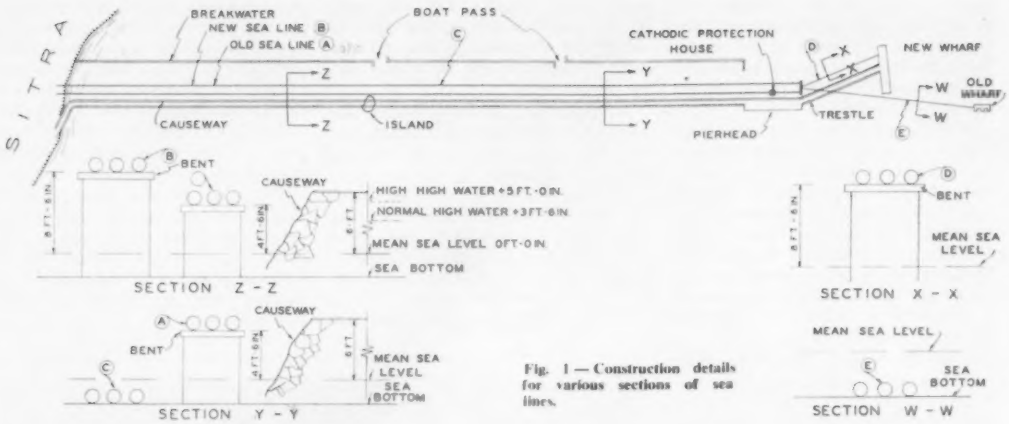

Fig. 1 — Construction details for various sections of sea lines.

How Bahrein Petroleum Combats Sea-Water Corrosion at Persian Gulf Installations

Mild steel exposed to sea water spray at the high atmospheric humidity and temperatures encountered in the Persian Gulf will corrode and pit at a very high rate. By minimizing spray, as was accomplished at Bahrein by raising some sections of lines or by building a breakwater, corrosion will be reduced to a rate where protection by paint or cut-back asphalt will be practicable.

by R. L. Davis* and R. F. Heinzerling†

BAHREIN PETROLEUM CO., LTD., an affiliate of California Texas Oil Co., Ltd., has operated at Bahrein in the Persian Gulf on an expanding scale since early in 1932. As part of this operation it has been necessary to install a number of sea lines for loading and unloading of crude oil and refinery products.

In the area of the loading terminal shallow water extends approximately 2½ miles off the beach and this has necessitated the installation of long runs of lines to reach a suitable deep-water anchorage. The operation of these sea lines has been attended by major corrosion and maintenance problems.

Development of facilities . . . The present layout of the Bahrein loading facilities is shown in Fig. 1. The first line, intended for crude shipments, was installed in 1934 and was supported above water on masonry piers out to the island from whence the line was laid on the gulf floor to a deep-water mooring in the area of the present old wharf. In 1936-1937 additional lines were added along the same route for loading refinery products and the old wharf was constructed. All of these lines were installed without any corrosion protection.

The portion of the original line located in shallow water between the island and the pierhead started leaking during 1938 and an investigation was made of the problem of protecting this line and the additional lines installed in 1936-1937. In 1940 the lines were raised on bents over the shallow water so that they could be more easily maintained; at the same time, the seaward portions of the lines in deep water were placed under cathodic protection. This cathodic-protection system was also tied into the old wharf structure to provide cathodic protection for the submerged steel work.

The period 1942 to 1945 was one of considerable expansion on Bahrein. During this expansion program the causeway, pierhead, trestle, and new wharf were constructed and additional sea lines were installed up to the capacity of the original bents. New bents were installed north of the existing ones in 1950 for additional lines.

The sea lines range in size from 6-in. nominal to 20-in. o.d. and were, with one exception, installed bare. They are all located on north side of a rock-fill causeway which runs parallel to the lines as far as the pierhead. Those lines installed prior to 1947 (Group A on Fig. 1) are supported on steel-and-concrete bents at an elevation of 4.5 ft. above mean sea level or 1 ft. above normal high tide. The shoreward half of those lines installed parallel to the causeway, during and after 1950 (Group B on Fig. 1) is supported at an elevation of 8.5 ft. above mean sea level and the seaward half is submerged and cathodically protected.

The new lines were installed in this manner on the basis of an economic study in which it was estimated that it would cost $530,000 to run these lines on bents to the pierhead as compared with $390,000 to install them on bents over the very shallow water and then under water from the point where the water was deep enough so that they could be submerged and cathodically protected. From the point of submergence, these lines are under water and cathodically protected to the pierhead (Group C on Fig. 1). From the pierhead to the new wharf (Group D on Fig. 1), the lines slope from an elevation of 4.5 ft. above mean sea level to the wharf elevation of 8.5 ft. above mean sea level.

From the pierhead to the old wharf the lines are under water and have

*Chief inspection engineer, and †materials engineer, California Texas Oil Co., Ltd.

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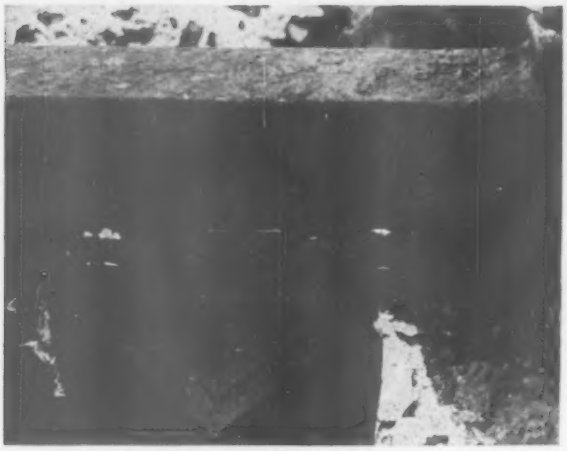

Corrosion of above-water (Group A) lines and supports has occurred at a rapid rate. As shown at left, webs of several of the support beams have corroded through. Lines (at right) are badly pitted and rusted, and many leaks have occurred.

been cathodically protected since 1940. Elevations have been very carefully given in the above data since experience has indicated that severe corrosion can be expected in the zone where there is wave action or spray. This is particularly true along the causeway where the rock fill breaks the waves and causes them to splash on the lines when the elevation is 4.5 ft. or less and wave splash is negligible over 8.5 ft.

The lines in Groups B and D in Fig. 1 are in good condition and are satisfactorily protected from corrosion by the annual application of cut-back asphalt. The lines identified as Groups E and C on Fig. 1 are submerged and have been cathodically protected since 1940 and 1950, respectively. The former group along with the submerged steel work of the old wharf up until 1945, and this portion of the old wharf plus the trestle to the new wharf since 1945, have been protected by two 500-amp. generators, one on the old wharf, and one adjacent to the pierhead as shown in Fig. 1.

These lines now have a heavy calcareous deposit over their entire length and have not leaked since cathodic protection was installed. They are at a potential of 1,040-1,200 mv., referred to a saturated copper-copper sulfate electrode, depending upon the state of the tide. The potential is greater than required for cathodic protection but the lines are maintained at this potential in order to secure partial tidal zone protection for the old wharf and trestle steel work.

The lines in Group C are protected by five 150-amp. rectifiers with a minimum current density of 8.5 ma. per square foot. This high minimum current was dictated by the fact that parts of the lines are exposed at low tide and by the desirability for standardizing on one size of current rectifier. No data are available on the line potential at this time but it has been necessary to gradually step up the rectifier potential to maintain full current output, indicating that polarization is progressing.

Group A Lines and Bents

The remainder of this article concerns only the sea lines and bents identified as Group A on Fig. 1. Prior to the installation of the causeway in 1945 corrosion of these lines was mild; however, they are now very severely corroded. The causeway is only about 2 ft. away from the nearest line at some points, and this line is continually wetted by salt spray and back splash of waves breaking against the pile bents and the causeway. The other lines on these bents are also wetted by spray from the causeway but to a lesser extent. In addition, since these lines are at a low elevation they become partly submerged during occasional periods of extreme high tides and strong north winds.

Corrosion has progressed at such a rate that the webs of several of the support beams have corroded through. The corrosion of the support beams, however, is not considered to be too serious since these beams can be replaced with the lines in service and with no loss in product loading or receiving. However, the lines are badly rusted and pitted and have had many leaks over the past few years in spite of the application of cut-back asphalt three times a year. Pitting and resultant leaks are considered critical since any down-time seriously affects loading rates and causes costly tanker delays.

External corrosion . . . External cor-

Cutback asphalt is applied three times a year to the Group A lines. In spite of this treatment, numerous leaks have caused reduction in loading rates and tanker delays.

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TABLE 1—TOTAL LEAK RECORD OF LINES IN GROUP A

	Prior to installation of causeway	1947	1948	1949	1950	1951	Six mos. 1952
Leaks per year (all lines)	4	12	23	41	46	58	58
Sea line closest to causeway (installed 1947)					9	15	27

rosion is progressing at a fairly high rate. A line near the middle of the group was gaged after 8 years of service and found to have lost up to .05 in. on top and .11 in. on the bottom wall due to a combination of general corrosion and lake-type pitting. The greater metal loss at the bottom of the line is to be expected, since the lower part is damp for longer periods of time due to wave action and spray. The upper part is kept relatively dry by the sun.

Actually the greatest leak frequencies are found (1) at the point where the lines rest on the support beams where water accumulates and lays for long periods of time, and (2) on the line nearest the causeway fill which is continually wetted by spray. General corrosion is not too much of a problem but the pit-type corrosion which leads to frequent leaks is serious. Leaks are usually repaired temporarily by applying clamps; then when the lines are available for permanent repair they are depressurized, welded, and put back in service.

The line which is closest to the causeway and is wet for the greatest percentage of time has shown the highest leak frequency of all the lines. Table 1 provides data on the leak record of the lines in this group.

Because of the severe leakage and the large expenditures required to replace these lines without service interruption, considerable effort has been spent on corrosion mitigation. From experience with the lines in Groups B and D, which are at a higher elevation than those in Group A, it was known that the lines in Group A could be adequately protected from corrosion if the effects of wave and spray action could be eliminated. This objective could be obtained in several different ways:

1. The sea lines could be raised in places to an elevation of 10 ft. above mean sea level. At this elevation experience indicated that corrosion from spray would not be a problem, even with the close proxmity of the causeway to the lines, and they then could be maintained easily with an annual application of paint or cut-back asphalt. This possible solution was discarded because of high cost.

2. The lines could be suitably protected either by building a breakwater as was actually done, or by raising them as in No. 1 above, from the beach to about midpoint between the beach and the pierhead. Beyond this point the water is deep enough so that the lines could be submerged and cathodically protected. From previous applications and experience it was known that cathodic protection would completely mitigate corrosion of these lines if submerged. This alternative was also discarded because of high cost.

3. The lines could be moved with a slight increase in elevation to the lee (south) side of the causeway. On this side, wave and spray action is negligible since the winds are predominantly from the north. A slight increase in elevation would be necessary to facilitate periodic painting. This solution was discarded because of cost and also because it would have the undesirable effect of boxing in the causeway and preventing possible future expansion.

4. From the experience with the lines in Groups B and D, which are at a higher elevation than those in Group A, it was known that the lines could be adequately protected from corrosion if the effects of wave and spray action could be eliminated. This objective could be obtained most economically in this case by building a rock breakwater along the lines at a sufficient distance north to prevent wave spray off the breakwater is shown on the lines.

The location of this breakwater is shown on Fig. 1. To date about 90 per cent of it is completed and it has formed a very effective stilling basin. The lines within it are no longer subject to wave action or spray and it is anticipated that they can now be adequately protected from corrosion by the annual application of cut-back asphalt. This solution to the problem turned out to be the most economical.

Wages Raised in Trinidad

The annual wage bill of the oil industry in Trinidad has been boosted by a new agreement.

As a result of a contract reached by representatives of the companies and the workers after several months of negotiations, hourly paid workers will receive a 7½-cent increase, and weekly paid, $3.60 additional.

The 2-year agreement is retroactive to August 25 and is estimated to mean a total increase of $3,500,000 annually in the labor costs for all the Trinidad oil companies. A wage agreement negotiated 2 years ago added approximately $1,500,000 annually to the wage bill of the Trinidad industry.

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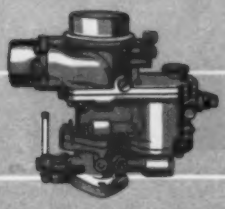

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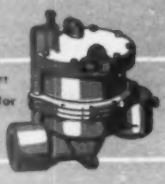
Combination Carburetor

Model "F"
Regulator

Model 2½ in. "Tg"
Combination Carburetor



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Model "G1"
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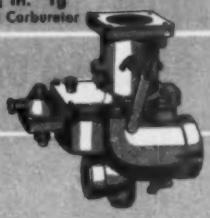

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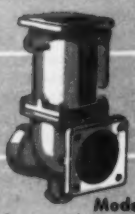
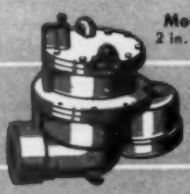


Model "A"
Gas Carburetor



Model "B"
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Model ¾ in. "Tg"
Combination Carburetor

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Creole Job-Training Program Objectives . . .

1. Personnel Development 2. Increased Efficiency 3.Lower Costs

Here's how they are being achieved at Amuay refinery

by H. C. Bobertz* and Joseph Green, Jr.†

CREOLE PETROLEUM CORP. is the largest producer of oil in Venezuela. It is a fully integrated company engaged in exploration, exploitation, production, transportation, manufacturing, and marketing of crude oil and products.

The Amuay Bay refinery is situated in Las Piedras on the peninsula of Paraguaná, the northernmost point in Venezuela. It has a distillation unit with a rated capacity of 60,000 bbl. per day (plans for doubling this capacity have been announced), a terminal that sits on the end of a 300,000 bbl. per day pipe line (a new 181,000 bbl. per day loop is being constructed) and ships an average of 7,984,659 bbl. of products and crude per month. In addition it operates the utilities and services necessary to maintain the camp living areas of the workers. Approximately 1,565 people are employed at Amuay.

*Supervisor of training and †training supervisor in the training section of the industrial relations department, Amuay Bay refinery.

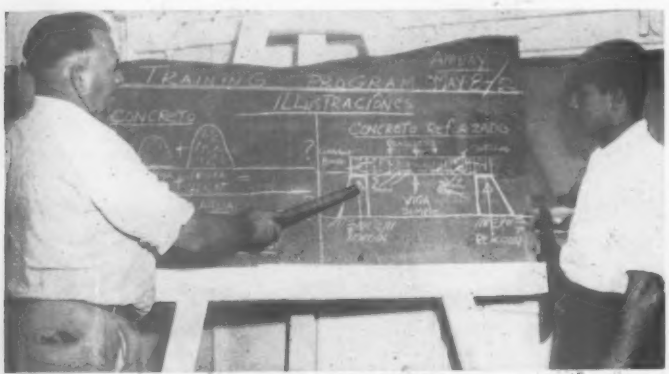
Because Amuay is situated on the peninsula it is somewhat isolated and the local labor market is consequently restricted. In fact, the biggest problem is the lack of skilled labor and the limited ability to attract and hold skilled people.

The geographical isolation, the limited labor market, the comparative newness of the refinery, and the policy of developing national personnel created a unique situation at Amuay and resulted in a simultaneous need for training in all areas. This presented a broad training problem.

Creole's training programs are designed to accomplish the accepted objectives of personnel development, increased efficiency and lower costs. They extend company-wide through all the phases of training starting with the testing and selection of employment candidates and continuing through job training, presupervisory training, supervisory training, personnel, and executive development.

Development of Venezuela personnel to qualify for highly skilled positions and also for efficient performance in their present jobs is an important policy of the company. The personal development program, while it is concerned with all workers, has as a primary aim the acceleration of the development of national workers.

This program requires a study of each worker at periodic intervals to determine his potential, the kinds of training he needs, and to recommend



A Venezuelan supervisor receives instructions from a bilingual engineer.

ways of achieving the necessary results. The Amuay situation, then, arose not only from the scarcity of skilled workmen already described, but also from the needs for development of the refinery workers. This article describes the area training plan which has developed to satisfy these needs as quickly as possible.

In March 1951, a review of the job training picture in Amuay indicated that although effective training was being carried out in several different sections, there was a definite need for intensifying and unifying the total job training effort. The survey indicated that of 1,209 workers reviewed, 785 were not yet performing at proper efficiency in the jobs for which they were being paid. This problem was discussed and developed with line supervisors, group heads, department heads, and members of the training committee, which is composed of line supervisors, and other members of management. Fundamentally, therefore, the development of this plan is a vast cooperative effort involving the thinking of most of our supervisory personnel.

The general job training plan which evolved from this approach is:

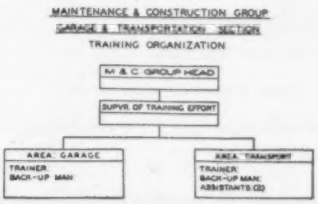
1. To divide each organizational division of the Amuay Bay refinery into training areas; each area consisting of a group of workers located in approximately the same locality and doing approximately the same kind of work. Examples of this area division are the carpenter shop, oil accounting, metals and laboratory.

2. To delegate and train a supervisor to serve as area trainer for each of the areas. This area trainer spends part of his working day in the development and carrying out of essential training plans.

The primary objective for the total job training effort was established as training the worker in those parts of his job which he cannot do at the required standard. In carrying out this objective, the steps which were followed in the establishment of the plan were these:

First, as previously described, the plan was developed as a cooperative venture by all supervisors concerned. The training section served as general coordinator for this development.

Then, through a series of meetings with the training committee and representatives from each organizational group, the training areas, and part-time trainers were established. This resulted in the formation of 63 training areas, each complete with a designated area trainer, backup man, and where necessary, assistants to perform the required job training. In addition to this, each organizational group such as accounting, materials, etc., appointed one of its members to serve as a supervisor of job training within that group. A typical training organization which developed from these meetings is shown below:



The responsibilities for effecting the required training were then jointly established as follows:

Training committee:

1. Reviews all job training efforts at least once each month.
2. Reviews and approves or makes recommendations for modification of all new training programs.
3. Advises management of progress and required areas of emphasis.
4. In general, serves as an advisory committee to maintain all training at top peak efficiency.

Group head or appointed supervisor of training effort:

1. Keeps accurate record of areas, area trainers, backup men and assistants for each area in his group.
2. Anticipates and makes provision for replacement of area training personnel when necessary.
3. Visits each area at least once each week to determine progress and problems.
4. Reviews all reports emanating from his areas.
5. Serves as line liaison with the training section on all training problems.
6. In general, is responsible for the efficient administration of all job training within his group.

Area trainers:

1. See that necessary job training is performed within their areas.
2. Keep accurate records of job breakdowns, training schedules, and training progress.
3. Submit monthly training reports on due dates.
4. Train backup men and assistants as required.
5. In general, are responsible to supervisors for the efficient functioning of job training within their areas.

Backup man:

1. Serves temporary replacement for area trainers during absences caused by vacations, illness, trips, etc.

Assistants:

1. Help in the completion of training programs as directed by the area trainer.

Training section:

1. Develops and conducts programs to train all area training personnel in training techniques and methods as required.
2. Coordinates all training efforts.
3. Assists all group coordinators in the solution of problems pertaining to job training.
4. Consolidates all area and group reports for management review.
5. Consults with group coordinators at least once each week on training progress and problems.
6. Provides translation and duplication services.
7. Collects and distributes all available job training material.
8. Duplicates copies of job breakdowns and prepares training schedules as required.
9. Coordinates common programs which apply to several organizational groups such as the fire-fighting program.
10. Checks with all concerned on program progress and quality.
11. In general, serves as a service station to assist in any way possible in the further development of the program.

After these responsibilities had been set forth, management requested the training section to conduct the first of a series of work-shop sessions for area trainers on "How to Conduct a Training Survey." The area trainers then conducted training surveys to determine job training needs in their own areas. These surveys resulted in:

(a) Names of trainees.

(b) Lists of required training programs by job classifications.

(c) Indications of urgency for each program.

After the training section conducted the second of a series of work-shop sessions on "How to Organize a Training Program," they discussed:

(a) Method of making training job breakdowns to determine the parts of a job. Fundamentally, this consisted of breaking a job into its major parts (work jobs) and then breaking each major part into the smaller parts of which it is composed (operations). This completed breakdown then consisted of all the operations of which a job is composed.

(b) Method of making training schedules to indicate what training an individual should receive in order to perform his present job satisfactorily. This completed training schedule is designed to show what training each individual trainee required in order to perform properly all the operations of which his job is composed.

The area trainer then organized their programs by making their job breakdowns and training schedules for their

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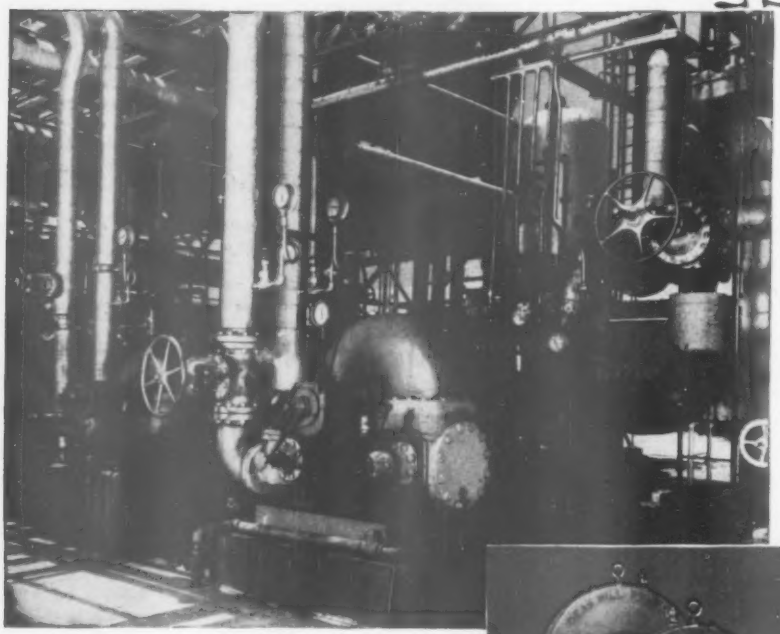

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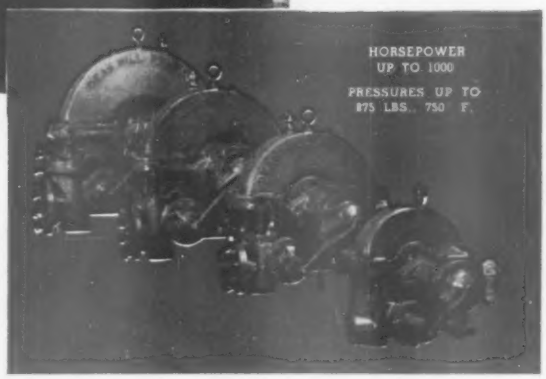

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individual areas. After this step was completed, the training section presented the third in the series of workshop sessions, "How to Conduct a Training Program." This session primarily consisted of:

(a) Fundamental principles of instruction.

(b) Common methods of training.

(c) Selecting a training method to fit a particular need.

Motion pictures were used in this phase of trainer training. These pictures, consisting of demonstrations of training techniques, both good and bad, were used as the basis of case discussions by the conferees.

Finally, in the last step, the area trainers then proceeded to launch the programs which they had organized.

At this point in the development of this approach to job training, a member of the training section was assigned full time to field work assisting the various area trainers in the solution of their training problems, as well as in setting up and continually reviewing reports and records.

As an additional aid in familiarizing line supervisors with techniques and evaluation methods, as well as to provide assistance to field trainers in reaching satisfactory solutions to training problems, management agreed to rotate area trainers through the training section on three-month assignments where they work as full-time assistants to the training staff.

The development of this program indicated the need for centralizing the instruction of common supplements to on-the-job-training. To satisfy this need, programs such as blueprint reading, use and care of hand tools, and shop arithmetic were developed and conducted as a joint effort by interested trainers. At the time of this writing, the program has gathered momentum to the point 104 different training programs are being conducted for an aggregate of 627 employes throughout our entire operation, including all shops and offices.

Fundamentally, this area approach has resulted in greater emphasis on our belief that job training is the line supervisor's responsibility and that the training section exists as a service agency to assist the line supervisor in discharging this responsibility. The standardization and simplification of our approach to surveying, organizing and conducting essential job training has resulted in a system in which the increase in training efficiency is very apparent. In addition, it has provided a common meeting ground for the discussion and solution of diversified training problems.

Although it is still too early in the development of the plan to attempt a full-scale evaluation of the results, we have ample indication that our final evaluation will be conclusive and positive.

Job training is being conducted successfully in other areas and activities in Creole, and has been for some time. It has been scaled to local needs, which in most cases were constantly changing and consequently on a smaller scale. Some of the formal job-training programs currently being carried on are for machinists in La Salina; laboratory technicians in Caripito; power-house operators in Jusepin, Caripito, and Punta Gorda; refinery operators in Caripito; welders at Lagunillas; marine cooks at La Salina; auto mechanics at Quiriquire, and instrument repairmen at Jusepin. The Amuay approach is a tremendous effort to get a big job done at one time as quickly as possible—and it's doing it.

Sweden Plans Treater

A new copper chloride treater for gasoline with a capacity of 6,000 bbl. daily is planned by Koppertrans Oljeaktiebolag at its refinery at Skarvik, Goteborg, Sweden. The plant has a crude-oil distillation capacity of 17,000 bbl. daily, with another 5,000 bbl. daily being added this year. Other facilities include 2,200 bbl. daily thermal reforming.

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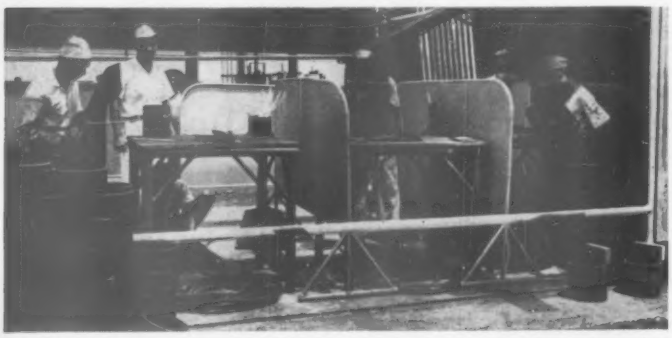
SUNGEI GERONG REFINERY . . . Aerial view of Standard-Vacuum refinery grounds near Palembang, Indonesia, showing warehousing, process units, and tank farm, are along Musi River. Plant capacity is 64,000 bbl. per day.

Maintenance Is a Major Challenge . . .

. . . at this Indonesian refinery

POSTWAR operations in Indonesia have posed numerous mechanical problems. Many of these stem from the economic difficulties of installing new facilities and are aggravated by rising costs and lower manpower output. One approach to satisfactory maintenance and construction performance has been mechanization.

Prior to 1942, the tankers from Balikpapan, Pladju, and Sungei Gerong could journey to Australia, China, and South Africa with laid-down costs at least as good as other potential suppliers. Today, the greatly increased production from the Middle East, an unrealistic tax structure, and spiraling labor costs in Indonesia itself, have seriously jeojardized the competitiveness of Indonesian oil. These three factors have all but eliminated the incentive of refiners to attempt to regain lost markets, to risk new capital for modernization and expansion. Nevertheless refiners have made determined efforts, since resuming operations in 1947, to offset rising costs through mechanical improvements and streamlining of operations wherever possible.



STANVAC TRAINING . . . Indonesians acquire many skills as a result of refinery operations at Sungei Gerong. This group is receiving instruction.

Refinery facilities . . . At the Sungei Gerong refinery of Standard-Vacuum Petroleum Maatschappij, a large investment was made for rehabilitation of war-torn facilities; but no new processing equipment has been installed. Briefly, this refinery consists of two shell-still batteries for crude topping, two vacuum pipe stills in series, two small pipe stills for crude and rerunning, four tube and tank thermal cracking coils, three Edeleanu plants, an alkylation plant, compression plant, absorbtion and other light-ends facilities, a 40,000-ton wax plant, sulfuric acid manufacture, and the usual treating facilities, steam and power generation, and other utilities.

Basic fuel products, as well as five grades of aviation gasoline, waxes and several specialties are the normal refinery output. Most of these operating units are 20 to 25 years old and maintenance has reached uneconomical proportions. Nevertheless demand for products requires continued operation.

within the limits of safety, pending ultimate modernization if and when economic conditions will permit.

Unusual maintenance requirements stem from several factors:

1. Excessive heat densities in overloaded fired units.

2. Metal fatigue due to age and continued service before replacements are possible.

3. Incomplete rehabilitation after wartime damage and problems arising from improvizations and cannibalization during the reconstruction period.

4. Relatively poor workmanship wherever supervisory ratios are low.

To expand briefly on these points, each major inspection turnaround at crude shell stills reveals further the damaging effects of heat spalling to brick or concrete insulation with resultant deterioration of steel supports. This has penetrated as much as 14 in. and the laborious replacement required is most uneconomical. It is not uncommon to terminate a cracking coil run (or at least swing from two stage to single) because tube hangers or connection supports have failed and many times a complete bridgewall or roof has required rebuilding. Some of this is the result of overfiring to meet commitments, some because of improvization with substandard materials.

Notwithstanding the relatively long runs made on thermal coils, the alternate heating and cooling cycles over many years have resulted in metal fatigue and failure in unexpected locations. Time and again breakdowns and emergency mechanical jobs have resulted from the fatigue of moving parts of archaic belt-driven sulfur dioxide compressors, central drive wax chillers, and press house conveyors. Although major modernization has been held in abeyance, installation of individual motor drives, and other minor improvements have been gradually effected.

Some prewar equipment does not meet the up-to-date A.P.I. code in regard to reinforcing pads, flange, thickness, etc. Installations made by the Japanese during the occupation are in this category. In most such instances it has been decided that if calculations indicate minimum metal, replacements to meet the code will be delayed until major turnaround work or modernization is undertaken.

Salt corrosion . . . A somewhat lesser maintenance problem developed during early postwar operations—corrosion of distillate worms. South Sumatra crude is fundamentally sweet so, when failures were encountered, considerable analysis of distillates and water in three distillates was necessary. From pH and iron-content determinations on water condensate it was decided that, notwithstanding the low salt content of South Sumatra crudes (25-35 lb. per 1,000 bbl.), the source of trouble was salt breakdown to form hydrochloric acid. It was estimated that this followed a stepwise breakdown:

1. At the lead stills of the crude batteries magnesium chloride started to hydrolize at 200°-250° F.—most of this $MgCl_2$ was apparently spent by the time the crude had progressed to the heavy naphtha distillation in the last stills, since the pH was much higher there.

2. Calcium chloride which hydrolizes at temperatures above 500° F. may have started to break down at the vacuum pipe stills but was the really nefarious element at the thermal cracking coils.

3. Feeding all crude residuum, in which the salts had been concentrated, to the cracking coils, with black-coil outlet temperature of 935° F., clean-coil 965° F., using water injection, was an ideal opportunity for salt breakdown. Probably all of the $CaCl_2$ and perhaps some of the NaCl was hydrolizing. In the distillate worms the pH was running about 3 to 3.5 and failure of return bends and bottom tubes occurred frequently.

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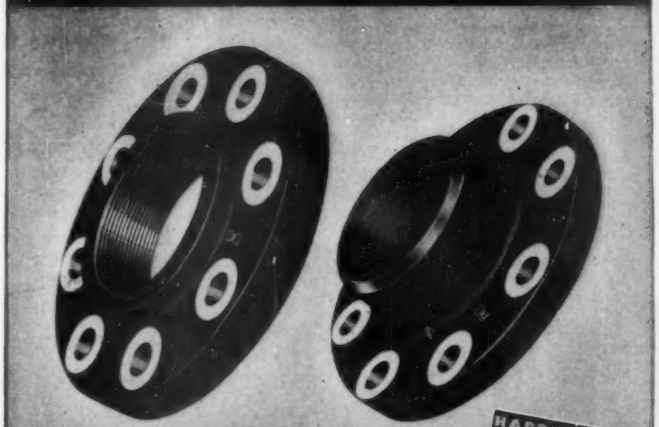

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The most logical solution was to inject ammonia to neutralize these acidic condensates—since little could be done to change operations or remove salts prior to crude processing. Ammonia-injection points were installed in the bubble-tower vapor lines of first frost and second stills at crude batteries and in the secondary tower overhead lines at cracking coils. It was necessary to closely control the injection with a needle valve and to run regular pH samples, since any excess NH_3 would affect admiralty exchanger tubes in other locations. In fact, once this did result in failure of a condenser bundle at the low-line gas-compression plant. Although it was expected, no serious buildup of NH_4Cl salts in reflux systems has been encountered. Corrosion at these units has been effectively prevented with decreased mechanical costs.

Maintenance facilities . . . Over and above refinery work, other necessary services that are peculiar to a refinery in this area add materially to the mechanical burden. Repairs to tankers, and shop service to expanded exploration and producing activities are also involved.

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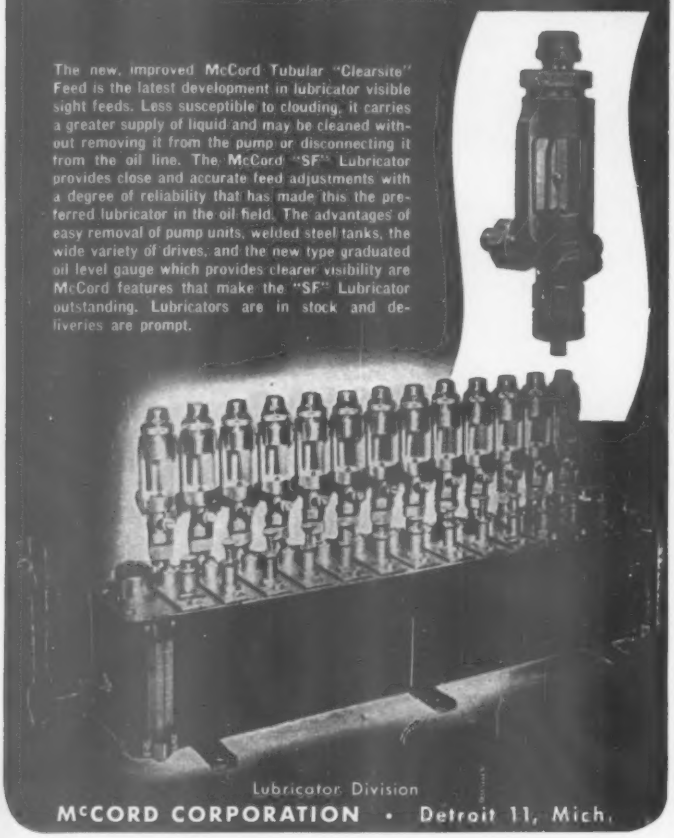
The new, improved McCord Tubular "Clearsite" Feed is the latest development in lubricator visible sight feeds. Less susceptible to clouding, it carries a greater supply of liquid and may be cleaned without removing it from the pump or disconnecting it from the oil line. The McCord "SF" Lubricator provides close and accurate feed adjustments with a degree of reliability that has made this the preferred lubricator in the oil field. The advantages of easy removal of pump units, welded steel tanks, the wide variety of drives, and the new type graduated oil level gauge which provides clearer visibility are McCord features that make the "SF" Lubricator outstanding. Lubricators are in stock and deliveries are prompt.



Lubricator Division
McCORD CORPORATION • Detroit 11, Mich.

Warehousing facilities often cannot cope with peak demands for materials and often uneconomical local fabrication is mandatory—with suppliers halfway around the world, even a 6-month parts and supplies inventory may not always prove sufficient. Long delivery times and unforseeable delays have made substantial warehousing improvements necessary and a half million dollars has been spent on extensions to prewar facilities, modern bins, and materials-handling equipment.

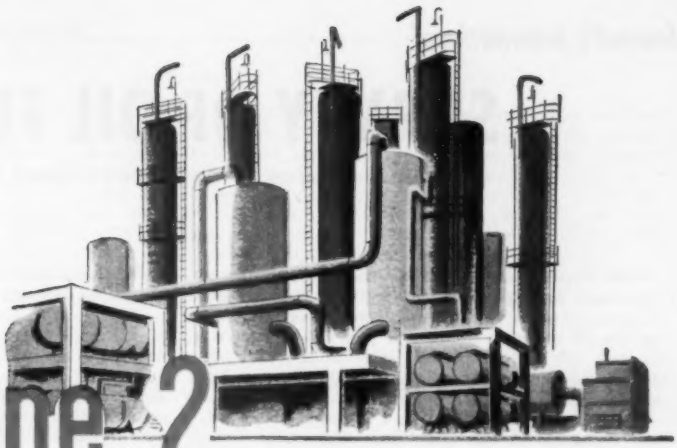
Prewar there was little incentive or necessity in Indonesia to consider improvements in material handling, construction tools, or mechanical methods. Basic wages, though comparatively liberal, were relatively low because of extremely low cost of living for both local and overseas personnel; and fringe emoluments and other payroll burden were also low. But in the past few years all of that has changed—in one sense for the better, but in matter of costs, entirely for the worse.

The normal rate of change probably jumped the equivalent of 50 or even 100 years in a 5-year period. Except for hand-labor output which dropped to 20 or 30 per cent of prewar, all other factors increased fantastically—materials, duty, wages. The total take-home pay increased this to almost 15 times 1941.

Equipment increase . . . A manifold increase in mechanical equipment has been one avenue to offset the higher cost and lower efficiency of postwar manpower. Dump trucks, stake trucks, straddle trucks, fork lifts, speed cranes, conveyors, tractors and traxcavators, new and improved machines and facilities for mechanical shops have been obtained. The refinery now has roughly $1,500,000 invested in construction and transportation equipment (excluding shops and warehouses), and programed replacements of some 20 per cent per year are in progress.

The job of training over 200 Indonesian drivers and crane operators plus helpers and garage mechanics has been a major challenge. With inexperienced personnel, inadequate shop facilities, materials shortages, operating factors have often been low but improvements are being made. An important lesson is being learned—that the construction equipment unit or automotive unit plus the operator is only part of the story—there must be a complete team for maximum efficiency.

Other forms of mechanization have come into play. The Sungei Gerong refinery has a home-made rock crusher, a batch concrete plant for both ready-mix and transit-mix trucks, road work is done by grader and roller using sand and tank bottoms.



Tenamene 2

inhibitor-sweetening

Cuts costs — eliminates danger of contamination — saves time and equipment

Tenamene 2 inhibitor-sweetening involves the use of this efficient Eastman gasoline additive both as a sweetening agent and as a gum inhibitor, and thereby makes possible the combining of two operations in a single step.

Tenamene 2 appears to act as an oxidation catalyst with regard to mercaptans. Its presence in sour gasoline enables refiners to convert mercaptans to disulfides merely by adding 10-20° Baume caustic and bubbling air through such gasoline at slightly elevated temperatures.

The Tenamene 2 itself is not reacted upon and thus remains in the gasoline after the sweetening process to provide effective protection against the formation of gums.

WHEN TO USE: If you are depending upon a solutizer process and have trouble in economically obtaining "Doctor" sweet gasoline, we recommend that Tenamene 2 inhibitor-sweetening be investigated as an adjunct to your present process. When Tenamene 2 inhibitor-sweetening and solutizer sweetening are combined, a considerable reduction in heat costs and a saving in time and equipment can frequently be realized, due to the decrease in recycling necessary in the solutizer units. The small amount of disulfides remaining in the gasoline after this combination treatment does not seriously affect tetraethyl lead susceptibility.

Where oxidation processes such as Copper sweetening or Doctor sweetening are used, we recommend that Tenamene 2 inhibitor-sweetening be considered as a replacement. While this process is also one of oxidation, it not only eliminates the dangers of copper or free sulfur contamination, but also eliminates the costly regeneration of the treating agents.

HOW TO SWEETEN WITH TENAMENE 2: Sour gasoline is first freed of hydrogen sulfide, organic acids and the more reactive mercaptans by a conventional caustic wash. 4 to 26 pounds of Tenamene 2 per 1,000 bbls. of gasoline are then added along with approximately 10 volume percent of 10° to 20° Baume caustic and air or oxygen. The resulting mix is thoroughly agitated and piped to a settler. The effluent from the settler is handled in the same manner as the effluent from conventional sweetening units, except that no more inhibitor is required.

Whatever your present sweetening process, it will pay to investigate Tenamene 2 inhibitor-sweetening. The staff of our gasoline laboratories will be pleased to work with you in determining how this process can be most effectively used in your refinery. Contact your local representative or write to Tennessee Eastman Company, Division of Eastman Kodak Company, Kingsport, Tennessee.

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SURVEY OF OIL FIELDS

Compiled by The Oil and Gas Journal's Statistical Department

Alaska

The Department of the Navy has been carrying out exploratory work since 1944 in the 37,000-sq. mile Naval Petroleum Reserve No. 4 in northern Alaska. Umiat on the Colville River in the eastern part of the reserve is the only oil field of promise thus far found, though shows, noncommercial oil, and considerable gas have been obtained from other structures.

Navy's program is aimed at a thorough and reasonable evaluation of the area rather than at developing commercial production which for utilization would require a pipe-line outlet across the mountains to the south. There have been indications the Navy would like to turn the program over to private operation.

More than $50,000,000 has been spent in the Alaskan oil exploration. Operation conditions are extremely difficult. During 1952, the program called for drilling five wells and continued seismograph and field geological work. Over-all conduct of the program, including drilling, is under contract to Arctic Contractors, a joint company formed by Exploration Contractors, F. F. Lytle Co., and Green Construction Co. Geological work is being performed by the Navy Oil Unit of the U.S.G.S.

ALASKA

Name of field— (1)	Year of discovery (2)	Producing depth (ft.) (3)	Number of wells: Flowing (4)	Pumping (5)	Shut in (6)	Drilling (7)	Prod. in bbl.: Daily average (8)	Accumulated to 7-1-52 (9)	Gravity, °A.P.I. (10)	Geological data on prod. formation, age and lithology (11)
Umiat	1950	700-1,500			7	1	(1)	(1)	36-37	Cretaceous ss.
Total Alaska					7	1				

(1) Test production only.

SUMMARY OF WORLD'S OIL FIELDS

Countries by areas—	Number of prod. wells	Accumulated production to 7-1-52 (thou. of bbl.)	No. of wells drilling
Western Hemisphere:			
Argentina	1,285	504,750	2
Bolivia	45	6,343	3
Brazil	152	2,018	4
Canada	3,067	270,829	199
Chile	14	1,834	3
Colombia	1,488	566,487	39
Cuba	230		4
Ecuador	1,091	52,945	13
Mexico	1,275	2,628,678	52
Peru[2]	3,033	424,793	30
Trinidad [1]	2,239	429,128	25
United States[2]	451,700	44,346,600	[2]5,665
Venezuela	8,062	6,492,602	115
Total	473,681	55,727,007	6,154
Europe and Africa:			
Algeria	19	216	4
Egypt	144	177,031	1
France[2]	586	21,746	3
French Morocco	85	1,981	4
Germany	2,259	112,618	10
Italy	229	1,847	2
Netherlands	163	22,110	2
United Kingdom	228	5,324	
Total	3,713	342,873	26
Middle East:			
Bahrein	76	151,053	1
Iran	42	2,654,500	
Iraq	42	622,952	9
Kuwait	115	624,072	4
Qatar	15	43,077	2
Saudi Arabia	124	1,152,833	8
Turkey	3	350	4
Total	417	5,248,837	28
Other Asia:			
Burma	54	290,000	1
India	570	47,500	4
Indonesia-New Guinea	2,092	1,545,477	28
Japan[1]		2,260	
Pakistan	28	1,400	2
Total	2,744	1,886,637	35
Total world excl. U.S.S.R. and satellites	480,555	63,205,354	6,243
Total U.S.S.R. and satellites[1]		8,821,646	
Grand total		72,027,000	

(1) Estimated. (2) Partly estimated.

Algeria

A new region of exploratory work is opening up in the Desert of Sahara in the southern part of French Algeria. Several well-known companies have obtained or applied for concessions in this area, including Royal Dutch-Shell, Regie Autonome des Petroles, and Cie. Francaise des Petroles. Geophysical crews are scheduled to begin work shortly in this arid section. Shell is reported to have acquired rights over more than 93,000 sq. miles in the South Algerian Sahara country through Cie. des Petroles d'Algerie in which Shell holds 65 per cent interest and French capital, 35 per cent.

Oued Gueterini field, located about 70 miles southeast of Algiers, is now the only producing area in Algeria. Production from this field has been increased approximately four times since the beginning of the year. It is operated by Soc. des Petroles d'Aumale in which the French and Algerian governments hold 50 per cent interest and French private capital the remainder. The company operates four rigs on wildcatting.

At present, the Oued Gueterini production is trucked to Algiers and then moved by tanker to Shell's Berre refinery in France.

ALGERIA

Name of field—	Year of discovery	Producing depth (ft.)	Number of wells: Flowing	Pumping	Shut in	Drilling	Prod. in bbl.: Daily average	Accumulated to 7-1-52	Gravity, °A.P.I.	Geological data on prod. formation, age and lithology
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Oued Gueterini	1949	550-2,100	6	13	9	4	1,000	216,378	38	Eocene ls.

Argentina

So far as is known, there have been no oil discoveries of consequence in Argentina since Campo Duran distillate and gas field near Aguaray in 1951. The state oil administration, Yacimientos Petroliferos Fiscales (Y.P.F.), at the time apparently believed it had found a major field, but no further information has been made available. Campo Duran is in the Salta Province near the Bolivian border.

The older Argentine fields are reported to be in a slow decline. The private companies, declining minority partnership with the government, are limited to acreage held in 1925. Y.P.F., which produces more than three-fourths the Argentine total, is hampered by materials shortages arising out of the country's lack of dollar exchange. The refusal of the government to allow dollar equipment imports continues to curtail field drilling and maintenance of production facilities by the private companies.

The Argentine Government still suppresses statistics relating to oil operations within the country, and for a number of years there has been no reliable, comprehensive information on the industry from that country. Unofficial reports together with the fact that Argentina is relying more and more on imported oil to meet rising consumption indicate the conditions that exist. Last August, for example, imports of petroleum into Argentina were reported at about 146,000 bbl. daily against total crude production which averaged about 68,000 bbl. daily. The domestic output has risen only slightly since the end of the war.

In August, Y.P.F. announced a discovery at a depth of about 7,200 ft. at a location some 25 miles from the Rio Gallegos. Again, shortage of equipment was expected to prevent any rapid development. Two years ago, Y.P.F. announced a new field on the Argentine side of the Tierra del Fuego but available information does not now show the field producing.

Y.P.F.'s headquarters are at Avenida Presidente Roque, Saenz Pena 777, Buenos Aires, and its New York office is Room 309-10, Empire State Building, New York 1. The principal private companies operating in Argentina are Standard Oil Co., Argentina (Jersey Standard), Avenida Presidente Roque, Diadema Argentina S.A. de Petroleo, Saenz Pena 567, Buenos Aires; and (Royal Dutch-Shell), Edificio Shell-Mex, Avenida Presidente Roque, Saenz Pena 788, Buenos Aires; and "Astra" Cia. Argentina de Petroleo, S.A., Avenida Alem 621 (R. 1), Buenos Aires.

ARGENTINA

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Principal producing districts										
Caleta							7,800			
Comodoro Rivadavia							44,500			
Mendoza							12,200			
Neuquen							7,000			
Salta							3,300			
Total Argentina[1]			5	1,280		2	74,800	504,750,000		

(1) Due to censorship, data on oil-industry operations in Argentina are not currently available. Above figures obtained from best available sources are estimates.

Bahrein

Production on the island of Bahrein has been stabilized at around 30,000 bbl. daily. The single field in the shaikhdom is operated by Bahrein Petroleum Co., Ltd., a member of the Caltex group of companies. A gas-injection program assists in maintaining production.

Since the end of the war, B.P.C. has drilled two deep tests in the field and explored the coastal waters but without success. Most of the charge for B.P.C.'s large refinery of about 200,000 bbl. daily capacity comes from Saudi Arabia. This crude is moved to Bahrein by submarine pipe line, and in the fall of 1952, work was under way to loop the under-water section of the line. This looping will make unnecessary the supplemental tanker movements of Saudi Arabian crude which have been taking place. Bahrein Petroleum Co., Ltd., has offices at 551 Fifth Avenue, New York 17, N. Y.

BAHREIN

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Bahrein	1932	2,000-2,500	76		17	1	30,000	151,053,236	35	Cretaceous ls.

(1) Excludes four gas-injection and four observation wells.

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  —"JUS" with slips
- Tubing collars pass without leakage!
- 3-inch adjustment on packing rubber!
- Rubbers can be changed without taking stripper from well head!
- Slips hold tubing fast but won't stick in bowl!

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Bolivia

The main problem facing the state-operated Bolivian petroleum industry is development of production. With Export-Import Bank financing, Yacimientos Petroliferos Fiscales Bolivianos constructed two refineries. Additional financing has been sought in Washington.

Bolivia has been attempting to interest foreign capital in the production side of the industry but so far without success. Concessions have been offered in the northern part of the country, and drilling areas on lease from Y.P.F.B. in the southern section. Bolivian oil officials believe that given the necessary drilling, production could be stepped up considerably. Plans earlier this year called for a $3,500,000 drilling program to develop 5,000 bbl. daily production at Camiri and an output of 15,000 bbl. daily from Los Monos field, a 1950 discovery which is awaiting development.

Y.P.F.B.'s headquarters are in La Paz, Apartado Corro 401, Avenida Gral, Camacho (Esquina Bueno). The United States representative, G. Rovira, is located at 707 Tower Building, Washington, D. C.

BOLIVIA

Name of field—	Year of discovery	Producing depth (ft.)	Number of wells				Prod. in bbl.			Geological data on prod. formation, age and lithology
			Flowing	Pumping	Shut in	Drilling	Daily average	Accumulated to 7-1-52	Gravity, °A.P.I.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Bermejo	1922	3,300		6	1		190	1,073,478	36	Permian sand
Camiri	1926	3,000	23	5	3	2	1,100	3,376,685	53	Devonian sand
Guairuy	1950	2,000	1				41	59,978		Devonian sand
Los Monos	1949	2,900			1				44	Devonian sand
Sanandita	1926	2,200		10	5	1	117	1,832,532	42	Devonian sand
Total Bolivia			24	21	10	3	1,448	6,342,673		

Brazil

Continued state-controlled exploration for oil in Brazil during the past year has been overshadowed by political controversy connected with the proposed creation of a new, all-embracing, government oil operation, Petroleo Brasileiro. The plan was placed before the Brazilian Congress early in the year by President Getulio Vargas and has been passed by the lower house. It is certain that the plan as finally authorized will continue to exclude any participation by foreign private capital. The law creating "Petrobras," the government oil company, is certain of approval by the Brazilian Senate. The proposal of President Vargas calling for a 51 per cent interest by the government will place the latter in control of all phases of the industry.

Brazil has an area of 3,286,000 sq. miles, which includes 10 different sedimentary basins having a total of approximately 1,000,000 sq. miles. All exploration and production is controlled by the Conselho Nacional do Petroleo, Avenida Presidente Wilson, 164, 90 Andar, Rio de Janeiro. Production comes from fields in the Bahia Graben west and north of Salvador and averages about 2,400 bbl. daily. Potential production is considerably higher and will be increased when the capacity of the Conselho's refinery at Mataripe is doubled.

Conselho is carrying on considerable exploratory work elsewhere in Brazil. It recently began drilling of a wildcat in the Parana basin in the southern part of the country. A 13,213-ft. unsuccessful test was drilled in the Marajo basin. Seismograph work is continuing in this area. During the first 7 months of this year, the government organization drilled a total of about 61,000 ft. of hole, and during July had five rigs running.

BRAZIL

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Agua Grande	1950	1,280		2				648	37	Cretaceous ss.
Aratu	1941	800		2			15	57,222	50	Cretaceous ss.
Candeias	1941	1,000	17	48		1	2,000	1,790,719	32	Cretaceous ss.
Dom Joao	1947	350		52		2	5,000	23,742	38	Cretaceous ss.
Itaparica	1941	800		18		1	500	67,014	30	Cretaceous ss.
Lobato-Joanes	1939	750		4			40	73,236	31	Cretaceous ss.
Paramirim	1950	1,200		1				4,910	35	Cretaceous ss.
Pedras	1951	250	1	7				125	41	Cretaceous ss.
Total Brazil			18	134		4	7,555	2,017,616		

Burma

Burma's current production rate represents the total amount that can be economically distributed and marketed. Any expanded output depends on success of the government in suppressing insurgent groups which have kept the country in a disturbed condition of semicivil war.

The principal operator is Burmah Oil Co. (Burma Concessions), Ltd., a subsidiary of Burma Oil Co., Ltd., which has headquarters in London, Britannic House, Finsbury Circle, E.C.2. The operating company was expected to complete four wells in Burma this year.

The Burmese Government has been seeking to raise the equivalent of about $14,000,000 to buy a third interest in a new company which will represent the entire oil industry of the country. Preliminary agreement between the companies and the government on this so-called "Joint Venture" was reached, but more recently reports indicated that the plan would be blocked by provisions of the Burmese construction requiring a 60 per cent interest by Burmese citizens in any company developing natural resources.

BURMA

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Chauk-Lanya[1]	1902	2,500		54		1	2,250	290,000,000	36	Oligocene sand

(1) Combined production by Burmah Oil Co. (Burma Concessions), Ltd., operations.

Canada

Western Canada's oil boom, which was touched off with Imperial Oil, Ltd.'s, Leduc discovery in 1947, continues on an expanded basis. Since the Leduc well, approximately a billion dollars have been invested in all phases of the Canadian oil industry. As a result, reserves of oil and gas with a gross worth of more than 5 billion dollars have been found, and Canada is now able to meet approximately 40 per cent of its roughly half-million-barrel-daily domestic requirement, with the prospect of covering most, if not all, of its needs, in a few more years.

Instead of a slowdown in development which had been anticipated in 1952, the more than 200 oil companies participating in exploration and production in western Canada added several hundred million barrels of new crude reserves and extended their area of operations on both the east and west sides of the sedimentary basin. An indication of the unabated interest in western Canada is given in the figures on rigs in operation. In early November, 176 rigs were running in western Canada, an increase of 24 from the year-earlier period. By contrast, the 2,592 rigs operating in the United States at the same time represented a decrease of 326 from the year-earlier period.

Outstanding among exploratory developments in Alberta this year were the two major trends south of Edmonton. A Devonian trend tailing south from Leduc field has indicated an ultimate reserve as great, perhaps, as Leduc itself, or more than 200 million barrels. This trend includes Wizard Lake, Bonnie Glen, and Pigeon Lake. The other trend was established by Cretaceous discoveries in the Joseph Lake area, about 40 miles to the east, but reserves here appear to be smaller than at Wizard Lake.

In southwest Manitoba, light oil has now been found in the Mississippian. Medium-gravity crude has been discovered in the Jurassic in Southwest Saskatchewan, and in the central part of the province, new discoveries of heavy crude have been made at Coleville and elsewhere.

In the Peace River district, especially on the British Colombia side of the border, major natural-gas reserves have been developed. The Nevis area in South-Central Alberta is shaping up as another highly important gas accumulation.

Most of the larger United States companies are taking part in the development in western Canada. Many of these companies handle the Canadian operations as a part of their domestic exploration and production programs, with local offices in Calgary. Canadian companies which have been active in the dominion for some time include Imperial Oil, Ltd., 56 Church Street, Toronto; British American Oil Co., Ltd., Bay and College Streets, Toronto; McColl-Frontenac Oil Co., Ltd., 360 St. James Street West, Montreal; Shell Oil Co. of Canada, Ltd., 25 Adelaide Street East, Tortonto; and Royalite Oil Co., Ltd., 606 Second Street West, Calgary, Alta.

CANADA
Alberta

Name of field—	Year of discovery	Producing depth (ft.)	Number of wells: Flowing	Pumping	Shut in	Drilling	Prod. in bbl: Daily average	Accumulated to 7-1-52	Gravity, °A.P.I.	Geological data on prod. formation, age and lithology
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Acheson-Stony Plain:										
Lower Cretaceous	1950	3,940-4,250	5		1		64	34,926	37	L. Cretaceous ss.
D2 and D3 zones	1950	4,950	77		3	14	4,027	1,679,143	36	U. Cretaceous dolo.
Alliance	1951	3,140			4		14	9,734	26	L. Cretaceous ss.
Armena	1951	3,240	240		2	15	1,063	210,435	36-38	Cretaceous ss.
Armisie	1951	4,040		7			282	76,588	38	L. Cretaceous ss
Barons	1950	4,100		2	1	1	84	39,529	30-34	Cretaceous ss.
Barrhead	1949	3,970			2			4,857	22-24	U. Miss. dolo.
Bashaw	1951	5,775	4		1		164	41,081	38-41	U. Devonian ls.
Big Valley:										
D2 zone	1950	5,240	28		1	2	1,035	309,729	30	U. Devonian dolo
D3 zone	1950	5,300	7				236	86,236	34	U. Devonian dolo
Bon Accord	1949	3,580	8			1	112	54,356	35	U. Devonian dolo
Bonnie Glen	1952	6,450	6		1	3	448	81,495		U. Devonian ls.
Bonnyville	1951	1,130		4	4	4	61	21,303	14	Cretaceous ss.
Brooks (Bantry)	[1]1947	3,250		1			58	65,977	22	L. Cretaceous ss
Bulwark	1950	3,060		1			16	10,733	34	Cretaceous ss.
Campbell	1949	3,700		11	2	5	147	152,057	30-33	L. Cretaceous ss
Camrose	1951	3,200		23	1	12	392	117,702	36	Cretaceous ss.
Caprona (Fenn)	1951	5,160	10		1	2	522	106,973	30-33	U. Devonian ls.
Conrad	1944	3,200		15	2		373	1,224,110	26	Jurassic ss.
Del Bonita-Twin River	1943	5,060		10		2	111	116,249	34-37	U. Mississippian ls
Dina	1929	1,700		2	1		51	99,663	13	L. Cretaceous ss.
Drumheller:										
Lower Cretaceous	1950	4,445	1		2	1	14	8,951	32	L. Cretaceous ss.
D2 zone	1951	5,335	9				332	69,189	35	U. Devonian ls.
Duhamel:										
D2 zone	1950	4,400		7	1	[2]2	296	85,766	34	U. Devonian dolo
D3 zone	1950	4,700		9			401	225,920	35	U. Devonian dolo
Ellerslie	[1]50	3,910		5		4	100	39,544	30	L. Cretaceous ss.
Excelsior	1949	3,820	33		1		2,159	941,687	35-36	U. Dev. dolo., ls.
Glen Park	1951	5,480	8				710	151,860	38-44	U. Devonian ls.
Golden Spike:										
D2 zone	1949	5,000	2				60	20,218	38	U. Devonian ls.
D3 zone	1949	5,363	7		1	[2]2	2,471	1,459,166	38	U. Devonian ls.
Joseph Lake	1949	3,270		75	4	2	2,800	1,442,631	37	Cretaceous ss.
Jumping Pound	1944	10,000	4		2	3	191	86,444	51-57	U. Mississippian ls.
Leduc-Woodbend:										
Lower Cretaceous	1948	4,200		22	3		790	794,954		L. Cretaceous ss.
D2 zone	1947	5,100		[3]456	26	[4]63	18,550	14,311,212	[4]35-42	U. Devonian dolo.
D3 zone	1947	5,300		[3]444	5		25,772	32,153,645		U. Devonian dolo
Lloydminster[5]	1939	1,920		163	88	[4]17	2,806	4,006,241	[4]9-17	L. Cretaceous ss.
Malmo	1952	5,220	6		2	4	187	5,199,600		L. Cretaceous ss
New Norway:										
D2 zone	1951	4,580	10				472	94,666	[4]32-39	U. Devonian ls.
D3 zone	1951	4,850	5		1		223	52,444		U. Devonian ls.
Pincher Creek	1948	11,755			2	3		29,288	53-54	U. Mississippian ls.

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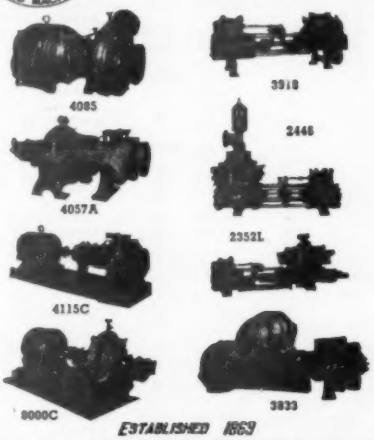

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CANADA (Continued)

Name of field—(1)	Year of discovery (2)	Producing depth (ft.) (3)	Number of wells: Flowing (4)	Pumping (5)	Shut in (6)	Drilling (7)	Prod. in bbl.: Daily average (8)	Accumulated to 7-1-52 (9)	Gravity, °A.P.I. (10)	Geological data on prod. formation, age and lithology (11)
Process:										
Mississippian	1945	3,300		[9]	[5]	[1]	[1]90	[1]487,245	[1]24-32	U. Mississippian ls.
Devonian	1944	3,985								U. Devonian dolo.
Redwater	1948	3,100		[2]908	11	5	55,934	48,934,378	33-36	U. Devonian ls.
Spring Coulee	1950	6,000		4		2	14	16,506	35-37	U. Mississippian ls.
Settler:										
Lower Cretaceous	1949	4,250		2	1	[5]	45	38,670	[1]27-30	L. Cretaceous ss.
D2 zone	1949	5,200	37		1		941	731,654		U. Devonian dolo.
D3 zone	1949	5,330	20				412	356,928		U. Devonian dolo.
Taber	1942	3,200		11	10	1	240	1,532,700	23	L. Cretaceous ss.
Turner Valley:										
Shallow zone	1913	3,100		2	1		4	519,781	[1]37-58	L. Cretaceous ss.
Limestone	1924	3,450-9,150	263		63		7,579	108,835,131		U. Miss. ls., dolo.
Vermillion	1939	1,850		16	20	1	108	1,291,005	7-10	L. Cretaceous ss.
Wainright	1923	2,250		5	9		57	329,810	20	L. Cretaceous ss.
Whitelaw	1950	3,880		1			5	9,271	28	Triassic ss.
Whitemud	1949	4,055	4				51	106,942	36	L. Cretaceous ss.
Wizard Lake	1951	5,975	19			2	3,098	754,404	38	U. Devonian ls.
Other fields[6]				12	9	5	270			
Total Alberta			613	2,227	295	184	136,542	230,010,557		
Manitoba										
Virden	1951	2,200				10	60	21,053	33	U. Mississippian ls.
New Brunswick										
Stony Creek	1910	1,000-3,200					39	600,398	37	Mississippian ss.
Northwest Territories										
Norman Wells	1920	1,050-1,900					973	3,611,832	39	Devonian ls.
Ontario										
Ontario	1859	500-3,000					536	31,168,880	26-39	Dev.-Ord.-Sil. ls., dolo.
Saskatchewan										
Coleville	1951	2,680		24	34	5	700	136,425	14	U. Mississippian ss.
Lloydminster[5]	1939	1,920		203	[7]113	([8])	3,300	5,199,600	[9]17	L. Cretaceous ss.
Total Saskatchewan				227	147	5	4,000	5,336,025		
Total Canada[5]			613	2,454	442	199	142,150	270,829,145		

(1) Barrel equals 35 imperial gallons. (2) Total producing wells in operation. (3) Oil discovery. (4) Total for entire field. (5) Lloydminster extends into both Alberta and Saskatchewan provinces. (6) Includes: Baxter Lake, Belloy, Cessford, Clive, E. Edmonton, Morinville, Namo, Normandville, and Pine Lake. (7) Shut in and suspended. (8) See Alberta. (9) From government reports.

Chile

Further increases in crude production are being made possible in Chile as a result of the completion of a new pressure-maintenance-gasoline plant. The plant is located in Manantiales field.

All the oil fields in Chile are located in Magallanes Province at the southern tip of the country. Prior to the discovery of Punta Delgado on the mainland in 1951, all the fields were on Tierra del Fuego south of the Straits of Magellan. Four rigs have been used in development of the fields, and two in exploration of other structures. Nine geophysical and geological crews are active.

All exploration and development in Chile are under control of the government's Empresa Nacional del Petroleo, Ramon Nieto 920, Santiago. New York offices are at 37 Wall Street. Most of the crude production is being sold under contract to Uruguay pending completion of a refinery which Empresa has under construction at Concon 10 miles north of Valparaiso.

CHILE

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Angostura	1950	7,500	1				30		46	U. Cretaceous ss.
Chanarcillo	1950	7,600	2				100	3,600	46	U. Cretaceous ss.
Delgada	1951	7,600			3			1,500	39	U. Cretaceous ss.
Espora	1949	7,500	1				15	3,000	46	U. Cretaceous ss.
Manantiales[1]	1945	7,500	3		24		170	777,800	42	U. Cretaceous ss.
Sombrero	1950	7,500	3		2	1	1,100	417,100	42	U. Cretaceous ss.
Victoria Norte	1950	7,500			3		60	13,200	46	U. Cretaceous ss.
Victoria Sur	1950	7,500	4		10	2	950	617,900	42	U. Cretaceous ss.
Total Chile			14		42	3	2,425	1,834,100		

(1) Natural gasoline-cycling plant of 30 M.M.c.f. capacity operating in Manantiales field.

Colombia

Discovery of the Totumal area by International Petroleum Co. of Colombia in the Middle Magdalena Valley late last year has given encouragement to a continued but relatively small-scale exploratory effort in Colombia. Though the significance of Totumal awaits results of further drilling, the area indicates possibility of other deep Cretaceous production in hitherto unsuspected areas. It is expected to be some time before whatever production is developed at Totumal is finally given an outlet to commercial markets.

The Texas Co. has had considerable though less spectacular success in its Colombian operations. The company is now drilling an important wildcat test south of Barco in the Cucuta region. Its 1946 discovery at Velasquez has been steadily developed, and a 21-mile pipe line is being built to serve the company's Ortega and Tetuan fields in the upper Magdalena Valley. The line will carry the crude oil to a topping plant yet to be built at Guamo.

Colombian Petroleum Co. (The Texas Co. and Socony-Vacuum) is running one rig each in the two Sardinata

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Colombia (continued)

areas. Another rig is operating in Rio de Oro field in the northern part of the concession. Because of the decline in production from Petrolea field, South American Gulf Oil Co. has rerouted the east end of its main pipe line directly into the field at Tibu. A 60,000,000-cu. ft. daily capacity gasoline plant is under construction in the field.

Colombia is one of the oldest oil-producing countries in South America, and in the twenties, its prospects were considered more favorably than those of neighboring Venezuela. There are still large areas not yet explored, and the government has carried out a program of liberalizing the petroleum laws to encourage private operations. This fall, the government made another modification giving an operator additional time to develop production in the interior Llanos region.

The De Mares concession, which reverted to the government from Tropical Oil Co. in August 1951, is now operated by the state-owned Empresa Colombiana de Petroleos, which headquarters at Bogota. International of Colombia is affiliated with International Petroleum Co., Ltd., 396 Alhambra Circle, Coral Gables, Fla. Other operators include Cia. de Petroleo Shell de Colombia, Edificio Virrey Solis, Carrera 9, 11-45, Bogota; Colombia Petroleum Co., Cucuta; and Texas Petroleum Co. of Colombia, Carrera 8, 12-59, Bogota.

COLOMBIA

Name of field—	Year of discovery	Producing depth (ft.)	Number of wells: Flowing	Pumping	Shut in	Drilling	Prod. in bbl.: Daily average	Accumulated to 7-1-52	Gravity, °A.P.I.	Geological data on prod. formation, age and lithology
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Contagallo Concession										
Cantagallo	1942	5,400-6,500	3		7	2	354	1,902,285	21	Eocene ss.
Dificil Concession										
Dificil	1943	5,500-5,843	12		5		1,500	4,457,452	43	Oligocene ls.
Fields										
Casabe	1941	2,500-5,800	28	252	49	17	38,284	53,686,943	21	Oligocene ss.
Velasquez	1946	6,700-8,455	13		9	4	3,200	1,908,264	26	Eocene ss.
Total Cantagallo, Dificil and fields			56	252	70	23	43,338	61,554,944		
Barco Concession										
Carbonera	1939	3,359		1	2		45	85,246	21	Eocene ss.
Petrolea[1]	1933	99-1,953	18	2	50		522	31,827,633	46	Cretaceous ss.
Rio de Oro	1937	1,865	6		5	1	788	352,398	39	Cretaceous ss.
Sardinata	1942	8,305	2		1	1	1,000	446,040	54	Cretaceous ss.
Tibu	1940	108-3,580	52	93	24	5	26,075	47,174,511		Eocene, Cret. ss.
Total Barco			78	96	82	7	28,420	79,885,828		

(1) Natural-gasoline plant of 90 M.M.c.f. daily capacity being installed in Petrolea field

De Mares Concession										
Colorado	1930	3,400-4,200	5	1	3		240	537,290	28	Eocene, Olig. ss.
Galan	1945	3,800-4,050		4	1		280	291,268	20	Eocene, Olig. ss.
Infantas	1915	300-3,600	1	249	185	2	8,500	161,318,134	26	Eocene, Olig. ss.
La Cira	1926	200-4,300	5	741	121	7	26,300	262,496,352	24	Eocene, Olig. ss.
Total De Mares			11	995	310	9	35,320	424,646,064		
Total Colombia			145	1,343	462	39	107,078	566,486,836		

(1) Five natural-gasoline and cycling plants are operating in De Mares Concession.

Cuba

Cuba has attracted attention in oil exploration off and on for the last half century. The latest drilling effort is that which has been made by Cuba Gulf Oil Co. This Gulf subsidiary has tested offshore prospects in northern Cuba but without commercial success. Gulf's Foreign Production Department is at 17 Battery Place, New York.

CUBA

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Jarahueca	1943	1,500		3		1	20		37-45	L. Cretaceous ls.
Motembo	1880	800		225		3	24			L. Cretaceous ls.
Total Cuba				230		4	44			

Ecuador

Ecuador's small integrated industry is able to cover current domestic requirements and make minor export shipments. The fields are all located on the Santa Elena Peninsula about 90 miles west of Guayaquil. The two principal operating companies are Anglo-Ecuadorian Oilfields, Ltd., whose field offices are at Santa Elena, Ecuador; and Manabi Exploration Co., Ltd., Houston, Tex. The latter company acquired the assets of the British-owned Ecuador Oilfields, Ltd., 2 years ago.

Although Ecuador has what is considered to be one of the most favorable petroleum laws in Latin America, two major exploratory efforts over the last 13 years, one by International Petroleum Co. and the other jointly by Shell and Jersey Standard, were abandoned without commercial success. Aside from these programs, both Manabi and Anglo-Ecuadorean are continuing exploratory work in an effort to maintain and extend production.

Anglo-Ecuadorean has drilled shallow tests in El Oro Province near the Peruvian border and a wildcat north of Santa Elena. Deep tests are being drilled in Ancon field. Manabi last July completed two new wells producing 300-400 bbl. daily, and in October announced a gas discovery about 5 miles southeast of Santo Tamos field. This gas well tested more than 5,000,000 cu. ft. daily, and additional drilling is under way to determine the oil possibilities of the structure.

ECUADOR

Name of field—	Year of discovery	Producing depth (ft.)	Number of wells: Flowing	Pumping	Shut in	Drilling	Prod. in bbl.: Daily average	Accumulated to 7-1-52	Gravity, °A.P.I.	Geological data on prod. formation, age and lithology
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Ancon[1]	1919	4,000-5,000	27	875		10	5,980	43,942,296	38	Eocene ss.
Santa Paula[2]	1934	800		53		1	100	1,077,318	29	Eocene ss.
Sn. Marco	1934	2,500	1	22		1	200	1,008,619	30	Eocene ss.
Tigre-Cautivo[3]	1917	700-3,500	3	110		1	2,050	6,916,494	37	Eocene ss.
Total Ecuador			31	1,060		13	8,330	52,944,729		

(1) Anglo Ecuadorian Oilfields, Ltd., operates three natural-gasoline plants in field. (2) Includes Las Conchas. (3) Includes Ahuiquimi and other fields. Manabi Exploration Co. operates an absorption plant in field.

Egypt

Egypt's oil industry is approaching a state of gradual decline in production. The older fields already are on the downgrade, and the newer areas discovered shortly after the war on the Sinai Peninsula are expected to drop rapidly in production in the near future.

Unworkable conditions laid down in Egypt's Mining Law of 1948 halted all exploratory work. Even field drilling was finished by the middle of this year, and there are now no drilling rigs operating in Egypt. The country's oil industry provides an illustration of the result of failure to seek new reserves continuously and aggressively. Imports are making up a greater proportion of Egypt's oil demand.

Hope that the long-awaited modifications of the petroleum law would be made earlier this year with the advent of the regime of General Naguib has been given a somewhat brighter outlook. The new government amended the objectionable 1947 company law which required 51 per cent of the capital of Egyptian companies be offered to nationals, and has been discussing changes in the mining law.

Although Socony-Vacuum Oil Co., Inc., has a 50 per cent interest in production from the Sinai Peninsula fields, all operations are now in charge of Anglo-Egyptian Oilfields, Ltd. (Shell) which has its head office in Shell House, Sharia Tewfik, Cairo. Anglo-Egyptian also produces the older fields, Ras Gharib and Hurghada, on the western side of the Red Sea.

EGYPT

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Asl	1948	2,870-3,870	6		4		15,137	12,431,614	22	Eocene ls.
Gemsa	1908	400-2,000			1			1,442,098	41	Miocene ls.
Hurghada	1913	700-2,500		24	2		777	37,885,736	30	Cret., Mio. ss.
Ras Gahrib	1938	1,200-2,500	14	195	24	1	23,415	106,923,512	26	Cret., Mio. ss.
Ras Matama	1948	1,940-3,200			3				20	Mio., Eocene ls.
Sudr	1946	492-1,307	5		10		5,247	18,348,454	23	Mio., Eocene ls.
Total Egypt			25	119	44	1	[2]44,576	177,031,414		

(1) Includes 25 wells on gas lift. (2) Average for month of June 1952.

France

The exploratory program which has been under way in continental France and territories of the French Union since the end of the war is the largest state-sponsored search for oil ever conducted. More than 40 rigs, half with a capacity of over 8,000 ft., have been in operation in continental France alone. The total expenditure in all French territory, including overseas regions such as North Africa and Madagascar, is expected to amount to the equivalent of nearly $300,000,000 by the end of 1955.

In continental France itself, the only foreign company participating is the French affiliate of Standard Oil Co. (N. J.) which is exploring a concession in the Bordeaux area. The other operators represent French interests largely backed by the government. Responsibility rests with the Bureau de Recherches de Petrole (B.P.R.).

The only discovery of significance in this program was at Lacq in 1949. The operating company is Soc. Nationale des Petroles d'Aquitaine. This company and others are continuing geological and geophysical work and test drilling in an effort to assess definitely the oil prospects of the other sedimentary basins of the country. Among these are Alsace Valley, Saone River Valley, Paris Basin, Lower Rhone River Valley, and Aquitaine basin. Indigenous production of oil is highly important to the French economy. The country is the second largest consumer in western Europe; its only important production is through a 23.75 per cent interest in Iraq Petroleum Co., Ltd.

Esso Standard, S.A., Francaise, has offices at 82 Avenue des Champs-Elysees, Paris 8e. The principal French companies engaged in exploration and production include Soc. Nationale des Petroles d'Aquitaine, 26 Rue de la Pepiniere, Paris 8e; Regie Autonome des Petroles, 40 Avenue Marceau, Paris; Pechelbronn S.A. d'Exploitations Minieres, 4 Rue Leon Jost, Paris 17e; and Soc. Nationale des Petroles du Languedoc Medterranecn, 39 bis, Rue de Chateaudun, Paris.

FRANCE

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Gallician	1951	6,000-7,000		4		1		3,400		Oligocene ss.
Lacq	1949	2,100-2,400	24			1	5,840	2,491,400	22	Cretaceous ls.
Pechlebronn	1813	600-4,000	4	553		1	1,020	[2]19,200,000	32	Oligocene ss.
St. Marcet[1]	1939	5,930			1			[3]50,300	45	Cret., cong.
Staffelfelden	1952	6,000-7,000	1				40	1,000		Jurassic ls.
Total France			29	557	1	3	6,900	21,746,100		

(1) Natural-gasoline plant of 42 M.M.c.f. capacity processing gas from St. Marcet field. (2) Estimate. (3) Production from distillate field.

French Morocco

The French company, Soc. Cherifienne des Petroles, is meeting with increasing success in developing the so-far small crude-oil production in French Morocco. Output at midyear represented an increase of slightly more than

French Morocco (continued)

50 per cent over the daily average for 1951 which in turn was 92 per cent greater than 1950.

The crude oil comes from a series of fields which are located in the Rharb basin in the northern part of the protectorate. Exploration of the entire basin and its edges is being carried forward aggressively by test drilling and geological and geophysical work. Discoveries during the past year included two areas, Bled Eddoun and Sidi Fili 2. The original Sidi Fili field was found at the end of 1950 a few miles northeast of the discovery at Oued Beth.

C.F.P. has three heavy rigs capable of depths of more than 12,000 ft., two medium, and three light rigs. The company's offices at 38 Rue de la Republique, Rabat (Maroc).

FRENCH MOROCCO

Name of field—	Year of discovery	Producing depth (ft.)	Number of wells: Flowing	Pumping	Shut in	Drilling	Prod. in bbl.: Daily average	Accumulated to 7-1-52	Gravity, °A.P.I.	Geological data on prod. formation, age and lithology
(1)	(2)	(3)	(4)	(5)	(11)		(01)	(6)	(8)	(7) (9)
Ain Hamra	1918	400-450		15			19	82,240	38	Miocene ss.
Bled Eddoum	1952	4,200	1			1	90	3,509	39	Primary ls.
Bou Draa	1936	1,500						164,378		
Mers El Kharez	1951	4,600	5				405	117,994	35	Primary Fract
Oued Beth	1947	2,900-4,600	29			1	490	788,778	35	Primary Fract
Oued Mellah	1948	1,800	16				210	166,790	35	Primary
Sidi Fili 1 and 2	1951-52	4,000-6,000	19			2	1,290	514,728	38	
Tselfat	1934	1,800						142,810		
Total French Morocco			70	15		4	2,504	1,981,227		

Germany, West

Despite somewhat pessimistic predictions which were made shortly after the war, exploration and development work in West Germany during the last 5 years has resulted in discovery of a number of new fields with a steady expansion in production. While the current output of about 35,000 bbl. daily is small in comparison with other producing countries, West German crude now supplies about a third of the country's total refinery demand.

Extent of the drilling effort in West Germany is indicated in the fact that there are a number of deep rigs in operation, and that more than 1,500,000 ft. is expected to be drilled in 1952. During the first half of this year, footage drilled was up 16 per cent over the same period of 1951 with a 22 per cent gain in field well footage; crude production increased 23 per cent, and natural-gas output—though still small—rose 23 per cent. During the same period, refinery output increased approximately 9 per cent.

Most important exploratory success in West Germany in 1952 was in the Province of Schleswig-Holstein. The German company, Deutsche Erdoel, A.G., found production on the western flank of the Heide structure, while Socony-Vacuum's German affiliate made a discovery in its Boostedt well in the eastern part of the province. Deuteche Erdoel also found oil in the Ploen wildcat northeast of Socony-Vacuum's discovery.

The two principal operators in West Germany which represent foreign interests are Gewerkschaft Brigitta (Jersey Standard and Royal Dutch-Shell) and Deutsche Vacuum Oel, A.G. (Socony-Vacuum). German companies active include Deutsche Erdoel, A.G. (DEA), Wintershall, A.G., Gewerkschaft Elwerath, C. Deilmann, and "Preussag" Preussische Bergwerke und Huetten, A.G.

GERMANY, WEST

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Baden District										
Forst-Weiher	1934	1,200-2,600		48			50	590,097	32-34	Triassic sand
Weingarten	1936	300-1,600		89			65	328,849	32-36	Tertiary sand
Total Baden District				137			115	918,946		
Emsland District										
Adorf	1946	4,000-4,400		1			10	45,801	30	L. Cretaceous ls.
Emlichheim	1944	2,400-2,900		54	57	1	2,600	4,444,138	25	L. Cretaceous ss.
Georgsdorf	1944	1,630-3,300	91	33	48		3,000	5,042,188	24-29	Cretaceous ss.
Lingen-Dalum	1942	2,600-3,900	3	111	38		2,600	3,278,670	30-32	Cretaceous ls.
Ruehlermoor	1949	2,000-2,800	26	22	6		2,800	1,402,772	25	Cretaceous ss.
Ruehlertwist	1949	2,350-2,900		32	14		2,100	917,924	25	Cretaceous ss.
Scheerhorn	1949	3,500-3,700	16	11	3		950	379,232	30	Cretaceous ss.
Total Emsland District			136	264	166	1	14,060	15,510,725		
Hamburg District										
Reitbrook	1937	1,400-2,600	65	65	74		980	9,231,285	21-22	L. Eocene ss., ls.
Hanover District										
Broistedt	1937	2,400-3,200		9	4		90	321,502	35	L. Cretaceous ss.
Calberlah	1945	400-1,160		8			13	38,803		
Eddesse-Nord	1950	500-1,170	5	8	1		200	48,657	26-34	L. Cretaceous ss.
Eddesse-Oelheim	1876	2,900-3,300		17	3		35	1,676,837	32	Triassic sand
Ehra	1939	500-820		13	1		8	77,313	16	Jurassic sand
Ecklingen-Weinhausen	1937	1,650-3,100		17	5		180	1,881,727	32-33	L. Cretaceous ss.
Eilte	1947	3,560-3,700		1			4	10,204	23	L. Cretaceous ss.
Eldingen	1949	4,900-5,300	10	14			1,700	676,928	35	Jurassic ss.
Fuhrberg-Hambuehren	1939	260-1,935		230	110		900	3,928,154	23	Jurassic ss.
Gifhorn	1935	600-820		40	7		37	322,976	17	L. Cretaceous ss.
Hademsdorf	1941	4,100-5,400		11	3		160	562,769	25-29	L. Cretaceous ss.
Hohenassel	1943	1,450-2,100		29	17		400	1,447,796	31	Jurassic ls.
Hohne	1951	4,380-6,500	14				1,250	344,790	34	Jur., Tri. ss.
Lehrte	1952	3,940	1						31	Jurassic ss.
Meckelfeld	1938	1,000-1,670		21	19		40	382,462	24	Cretaceous ls.
Moelme	1935	160-1,000		20	7		65	1,055,561	32	Cretaceous ss.
Neinhagen	1899	600-5,350	2	201	154		1,600	32,099,748	22-32	L. Cretaceous ls., ss.
Neinhagen-Haenigsen	1940	2,245-2,770	3	31	4		450	3,042,747	24-28	L. Cretaceous ss.
Oberg	1919	500-1,900		63	5		140	104,524	36-40	L. Cretaceous ss.
Steimbke	1936	790-3,700	5	238	11		1,900	4,706,037	18	L. Cretaceous ss.
Suderbruch	1949	3,900-7,650	34	11	5	6	3,000	1,472,352	25-37	L. Cretaceous ls., ss.

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GERMANY, Hanover (Continued)

Name of field—	Year of discovery	Producing depth (ft.)	Number of wells: Flowing	Pumping	Shut in	Drilling	Prod. in bbl.: Daily average	Accumulated to 7-1-52	Gravity, °A.P.I.	Geological data on prod. formation, age and lithology
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Thoeren	1941	1,550-4,000	1	64	4		400	1,310,935	19-34	L. Cretaceous ss.
Vorhop	1952				1					Jurassic ss.
Wathlingen	1950	2,000		9	1		260	116,641	27	Cretaceous ss.
Wesendorf	1943	1,250-6,000	29	34	13		1,680	3,462,537	17-41	Cretaceous ss.
Wietze	1874	300-1,000		308			540	17,109,510	18-27	Cretaceous ss.
Total Hanover District			104	1,397	375	6	15,052	76,201,512		
Schleswig-Holstein District										
Heide	1935	3,000-5,935	3	65	48		1,350	10,160,157	18-32	L. Cretaceous ss.
Weser-Ems District										
Etzel	1942	4,550-4,700		3			70	249,346	13	Jurassic ls.
Hemmelte—West	1951	3,700-4,200	9	1	2	3	520	72,576	32	Jurassic ls.
Quakenbrueck	1950	1,270-1,950		10	2		100	272,935	35	L. Cretaceous ls.
Total Weser-Ems Dist.			9	14	4	3	690	594,857		
Total Germany			317	1,942	667	10	32,247	112,617,482		

India

Assam Oil Co., Ltd. (Burmah Oil Co., Ltd.), has tested several areas in the Assam region of India but so far without commercial results. The company failed to obtain production in its Naga Hills wildcat in Upper Assam this year but made location for a second test. Another deep exploratory well was commenced early in the year about 13 miles south of Tinsukia in the northeast corner of the state.

Standard-Vacuum Oil Co. completed an aerial magnetometer survey of about 73,000 miles of the Bengal basin, and has been reported planning further work in this region.

All of India's production currently comes from Assam Oil's single field at Digboi. During 1952, slight increases in production were made in this 60-year-old field. B.O.C., of which Assam Oil is a subsidiary, has offices in Britannic House, Finsbury Circus, London E.C.2. Standard-Vacuum's main offices are at 26 Broadway, New York.

INDIA

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Digboi	1890	3,000	20	[1]550	150	4	6,000	47,500,000	36	Miocene ss.

(1) Includes 350 wells on gas lift.

Indonesia

The outstanding event on the producing side of the Indonesian oil industry this year was commencement of operations in May by Caltex Pacific Petroleum Co. The first tanker shipment of crude from a new tanker terminal at Pakning climaxed an exploratory program that began in the middle thirties. This oil comes from Minas field in central Sumatra. Since reentering the arena in 1949, Caltex Pacific Petroleum has concentrated on field development but geophysical work is to be resumed in the near future. The company has one rig on exploratory work.

The two older companies in Indonesia are affiliated with Standard-Vacuum Oil Co. and Royal Dutch-Shell. In South Sumatra, both companies carry on integrated operations, and the output of the refineries is marketed over a wide area of the Far East. The bulk of the Indonesian production comes from properties in South Sumatra. Because of current political conditions, Shell is still unable to reenter north Sumatra where it had production and a refinery prewar. Local Indonesian interests are understood to be operating the facilities on a small scale.

Political and legal uncertainties hang over the industry in Indonesia. The need for greatly increased production is recognized, but the companies are asking a realistic approach by the government to the questions of royalties, taxes, export and import fees, and other charges levied against the operations. As conditions now stand, the industry is reluctant to make the major new investments required until the future status is clear. Indonesia's lagging position as an important world producer is shown in the fact it is still slightly below the 1940 level in contrast to the huge gains in output which have been made by nearly all other oil countries.

The three companies operating in Indonesia are running a total of around 24 rigs on both field development and exploration. Shell's main operating company is N. V. de Bataafsche Petroleum Mij., head offices, Carel van Bylandtlaan 30, The Hague, the Netherlands. Indonesian offices of N. V. Standard-Vacuum Petroleum Mij. are at Medan Merdeka Selatan 18, Katak Pos 154, Djarkarta. Caltex Pacific Petroleum has offices in the Netherlands at Korte Nijverberg 5, The Hague.

INDONESIA-NEW GUINEA

Borneo

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Anggana-Muara	1902	380-3,200	3	88			2,350	64,755,300	30	Miocene ss.
Balikpapan	1903	740-765			1			234,480	14	Miocene ss.
Bunju	1930	1,970-3,100	1		16	2	240	541,200	31	Pliocene ss.
Sambodja	1910	160-4,400	1	49			1,170	54,637,700	31	Miocene ss.
Sanga Sanga	1897	430-2,900	5	100		1	4,480	147,937,300	34	Miocene ss.
Sangatta	1940	1,640-4,200			[1]1			1,150	36	Miocene ss.
Tandjung[2]	1938	2,500-4,300	1		21	1	[3]20	643,300	39	Eocene ss.
Tarakan	1906	195-2,400	3	474	2		6,250	167,794,500	18	Pliocene ss.
Total Borneo			14	711	41	4	14,510	436,544,930		

(1) Completed well, production suspended. (2) Field shut in, pipe line not yet available. (3) Production for operators' own use.

Brunei

Seria	1929	1,600-6,900	104	[1]99	77	5	103,118	[2]193,696,052	33	Tertiary ss.

(1) Includes 56 wells on artificial lift. (2) Includes estimated oil produced during Japanese occupation.

INDONESIA-NEW GUINEA (Continued)

Ceram

Name of field—	Year of discovery	Producing depth (ft.)	Number of wells: Flowing	Pumping	Shut in	Drilling	Prod. in bbl.: Daily average	Accumulated to 7-1-52	Gravity, °A.P.I.	Geological data on prod. formation, age and lithology
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Bula Lemun[1]	1897	240-920						8,293,000	23	Plio.-Tri. sand

(1) Inactive.

Java

Kawengan	1926	1,750-2,700	7	56		1	12,100	48,422,600	33	Miocene sand, ls.
Kruka	1929	970-1,600		[1]57			980	8,461,200	26	Miocene ls.
Ledok[2]	1896	320-3,200						21,125,000	43	Miocene ss.
Lidah Kulon[3]	1896	490-1,330						33,369,000	25	Miocene ls.
Nglobo-Semanggi Banjuasin[3]	1897	370-3,350						18,044,000	43	Miocene ss.
Total Java			72	113		1	13,080	129,421,800		

(1) Includes 1 well on artificial lift. (2) Inactive due to political disturbances. (3) Field inactive.

Sarawak

Miri	1911	300-3,050		108	226		1,000	[1]72,211,585	35	Tertiary ss.

(1) Includes estimated oil production during Japanese occupation.

SUMATRA

(Northern District)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Dj Rajeu	1929	2,520-2,590						550,000	54	Pliocene ss.
Gebang	1936	2,970-3,480						135,000	54	Miocene ss.
Pangkalan Susu	1917	1,550-2,100						6,527,000	56	Miocene ss.
Pase	1939	2,000						52,000	50	Tertiary ss.
Pelu Pandjang	1928	1,640-2,400						11,243,000	55	Miocene ss.
Perlak	1900	160-2,200						47,870,000	57	Miocene ss.
P. Tabuhan	1937	3,300-3,500						2,283,000	52	Miocene ss.
Rantau	1929	1,040-2,560						55,513,000	48	Miocene ss.
Sarang Djaja	1926	3,300-3,500						3,283,000	52	Miocene ss.
Telaga Said Darat K. Gadjah	1893	210-720						23,621,000	51	Miocene ss.
Total Sumata N. Dist.								128,225,000		

(1) All fields inaccessible on account of political disturbances.

(Central District)

Duri[1]	1940	730			6			[2]6,027	22	Miocene ss.
Lirik-Ukui	1941	1,800						566,778	34	Tertiary ss.
Minas	1944	2,460	20		21	4	14,000	[3]1,168,380	38	Miocene ss.
Pungut	1951	2,940			2			[2]290	39	Miocene ss.
Sebanga[1]	1940	1,250			3			[2]2,369	30	Miocene ss.
Total Sumatra Cent. Dist.			20		32	4	14,000	1,743,754		

(1) Inactive since war with Japan. (2) Oil for field use. (3) Production for regular shipment began in March 1952.

(Southern District)

Abab	1951		2			1	200	159,860		Tertiary ss.
Babat	1901	100-1,050	1	[2]15			60	8,296,100	39	Miocene ss.
Badjubang	1927	2,700-3,300		[1]8	23		2,740	28,622,600	47	Miocene ss.
Benakat	1933	1,600	57	68	9		9,600	51,027,171	38	Tertiary ss.
Betun	1951		5				1,900	1,399,414		Miocene ss.
Betung[3]	1923	180-950						2,100,000	40	Miocene ss.
Djirak	1930	1,000	4	113	6		6,600	30,450,895	38	Tertiary ss.
Gunung Kemala	1938	6,070-6,250	7		1	1	3,000	1,728,800	35	Miocene ss.
Karang Ringing[4]	1903	160-1,200						1,572,000	42	Miocene ss.
Kenali Asam	1931	1,700-4,100	38		30	1	14,260	32,281,506	46	Miocene ss.
Kluang[4]	1914	2,300-2,600						27,882,000	40	Miocene ss.
Krub	1951		4	7	1		650	1,625,396		Tertiary ss.
Limau	1928	5,200-5,450	14			2	7,500	9,710,300	28	Miocene ss.
Mangundjaja	1935	600-2,200	1	53	5		2,860	12,431,850	24	Pliocene ss.
Meruo Senami[3]	1938	2,400-2,650						95,700	48	Miocene ss.
Muara Enim Complex[5]	1903	300-1,150		9			100	28,270,000	45	Pliocene ss.
North Lembak	1941	5,250			1			2,110	40	Miocene ss.
Radja	1941	7,000	13	0	1	2	3,300	3,655,595	40	Tertiary ss.
Setiti	1936	1,850-1,970			2				26	Miocene ss.
Suban Djerigi	1905	1,300-2,500		[2]24			500	34,345,569	47	Mio.-Plio. ss.
Talang-Akar-Pendopa	1922	2,600	280	48	19	1	42,250	181,706,343	28	Tertiary ss.
Talang Djimar	1937	3,600-4,200	47	2	9		18,400	57,817,500	29	Miocene ss.
Tandjung Tiga	1940	4,400-4,600	23			1	8,200	6,357,300	26	Miocene ss.
Tempino	1931	1,930-2,700	29	[2]27	2		7,920	44,065,000	46	Miocene ss.
T. Luntar[4]	1912	1,200-2,800						4,072,000	56	Pliocene ss.
Total Sumatra S. Dist.			525	374	109	9	130,040	569,185,934		

(1) Includes 5 wells on artificial lift. (2) Includes 14 wells on artificial lift. (3) Field inactive. (4) No activity on account of political disturbances. (5) Includes Batu Kras, Sei, Taham. (6) Artificial-lift wells. (7) Includes 1 well on artificial lift.

New Guinea

Klamoemoek		600			3	1				
Klamogoen						1				
Klamono	1936	300	1	16	5		4,580	6,243,700	19	Miocene ls.
Mogoi	1940	1,250			4	1		439	46	Miocene ls.
Tambuni						1				
Wasain	1940	2,900-3,225			1	1		862	48	Miocene ls.
Total New Guinea			1	16	13	5	4,580	6,245,021		
Total Indonesia-New Guinea			671	1,421	497	28	280,328	1,545,477,076		

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Iran

Iran's once-great producing industry has been almost completely idle since the summer of 1951 when exports were halted as a result of nationalization. Since then, Iranian oil has become a matter of major international concern several attempts failed to settle the problem.

The fields are being produced on a small scale by National Iranian Oil Co. which has headquarters at Korramshahr. Lacking export markets, the production is limited to roughly the amount required for internal consumption within Iran. Partial operations are being carried on at the Abadan refinery for this purpose.

In absence of any settlement with the Iranian Government, Anglo-Iranian Oil Co., Ltd., still lays legal claim to the properties and any oil that is produced from them. From the broader standpoint, prospects of an agreement between Britain and Iran the latter part of this year seemed more remote than at any time since the nationalization issue arose.

Apart from the controversy over the nationalization of Anglo-Iranian's properties, another government operation, Iranian Oil Co., this year made what is reported to be a field discovery in the Qum area about 50 miles south of Teheran. Iranian Oil Co. has been exploring the country outside the existing concession since 1947, using a group of Swiss geologists. Drilling has been done under contract to Drilling & Exploration Co.

IRAN

Name of field—	Year of discovery	Producing depth (ft.)	Number of wells				Prod. in bbl.		Gravity, °A.P.I.	Geological data on prod. formation, age and lithology
			Flowing	Pumping	Shut in	Drilling	Daily average	Accumulated to 7-1-52		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Aga Jari	1937	4,870	2		10	4	14,300	433,000,000	35	Olig., Mio. ls.
Gach Saran	1928	800	1		2		100	131,000,000	32	Olig., Mio. ls.
Haft Kel	1928	1,700	1		24	1	150	1,001,000,000	38	Olig., Mio. ls.
Lali	1938	4,500	1		3	3	800	16,000,000	36	Olig., Mio. ls.
Masjid-i-Sulaiman	1908	1,270	35		40	1	7,800	1,015,000,000	38	Olig., Mio. ls.
Naft-i-Shah	1923	1,940	1		1		2,600	17,000,000	42	Olig., Mio. ls.
Naft Safid	1934	4,460	1		13	3	500	35,000,000	36	
Pazanun	1937				3			6,500,000		
Total Iran[1]			42		96	[2]12	26,250	[3]2,654,500,000		

(1) Iranian oil industry was nationalized in March 1951. Operations have been appreciably reduced since government took over. (2) Drilling suspended. (3) Estimated.

Iraq

Considerable activity has been under way in Iraq's two principal fields, Kirkuk and Zubair, as a result of completed and projected expansion in pipe-line outlets. Total Iraq production was rising to new records almost monthly during 1952. In the spring, Iraq Petroleum Co., Ltd., completed a new 30 and 32-in. line from Kirkuk to Banias, Syria, and additional pumping facilities were brought into operation later in the year.

A second (Avanah) dome has been brought into production to augment the field's output, additional separator and stabilization units erected, and field line capacity increased. In addition, the company has been carrying out exploratory drilling both to test the deeper horizons in the field and to assess the prospects of other structures in the general area.

Another program has been under way at the same time in Ain Zalah field to the north. A 135-mile, 12-in. crude-oil line has been completed to bring this field into commercial production at a scheduled rate of about 20,000 bbl. daily beginning the latter part of this year. The concession obligation called for commercial production from this area by March 1953.

The greater part of the drilling effort in Iraq continues to take place in Zubair field in southern Iraq. This is the deepest producing field in the Middle East. Zubair production is scheduled to rise sharply following completion, probably late next year, of a new 24-in. pipe line to the Shatt-el-Arab tanker terminal at Fao. The program calls for a production of more than 160,000 bbl. daily from the area by the end of 1955.

Three different companies are engaged in operations in Iraq, all of them associated under the same ownership. I.P.C. itself operates Kirkuk field and the Mediterranean pipe lines. Basrah Petroleum Co., Ltd., handles the Zubair operation, while Mosul Petroleum Co., Ltd., is engaged in the Ain Zalah and other northern Iraq development. I.P.C.'s London offices are at 214 Oxford Street, Oxford Circus, London, W.1. Field headquarters are at Kirkuk in Iraq. Basrah Petroleum has local offices at Makinah (Basra), Iraq.

IRAQ

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Ainzalah	1939	5,500	(1)		9	1	[1]19,000	296,600	30	Cretaceous ls.
Kirkuk	1927	2,750	29		15	2	311,000	574,820,000	37	Miocene ls.
Naft Khaneh	1923	3,000	2				10,000	40,000,000	43	Mio., Olig. ls.
Nahr Umr	1949				1					
Qaiyarah	1927				1					
Zubair	1949	11,000	11		5	6	45,500	7,833,000	35	Cretaceous ss.
Total Iraq			42		31	9	385,500	622,951,600		

(1) Production rate after October 1952.

Italy

In Italy, other than on the island of Sicily, emphasis is on discovery and development of natural gas. Italy's natural gas reserves are now officially estimated at more than 1.8 trillion cubic feet with production currently amounting to around 160 million cubic feet per day. A network of pipe lines is constantly being extended over northern Italy.

Through expanded utilization of natural gas, Italy hopes to cut coal imports by 75 per cent and to reduce fuel-oil imports substantially within the next 5 to 10 years when the pipe-line system should be extended into the southern part of the country. Long-term plans envisage export of natural gas to Switzerland and France. Most of the gas now being consumed in northern Italy is by in-

Italy (continued)

dustries. These consumers find the fuel advantageous even though its selling price is based on current domestic prices of coal.

Italy's minor production of crude oil has increased sharply during 1952. The light crude comes principally from Cortemaggiore field where a new American-designed natural-gasoline plant, rated at 106 million cubic feet daily, was placed in service in early summer. Practically all gas and oil development in northern Italy is in the hands of state-owned Azienda Generale Italiana Petroli, Cia del Tritone 181, Rome. A.G.I.P. also holds interests in a number of other companies, including Soc. Nationale Metanodetti which builds and operates the gas pipe lines. Soc. Petrolifera Italiana (Standard Oil Co., N. J.), has small production of less than 100 bbl. daily in northern Italy. This company is located at Fornovo Taro,

Foreign capital exploring for oil in Italy is largely confined to Sicily which under its regional autonomy has a more favorable petroleum law. Three companies are involved, Gulf Oil Corp. and MacMillan Petroleum Corp., through the joint Mediterranean Oil Co., and Anglo-Iranian Oil Co., Ltd., through d'Arcy Petroleum Co., Ltd. The Gulf-MacMillan program is handled from Gulf's Foreign Production Office, 17 Battery Place, New York. The d'Arcy company's offices are in Britannic House, Finsbury Circle, London E.C.2.

ITALY

Name of field—	Year of discovery	Producing depth (ft.)	Number of wells: Flowing	Pumping	Shut in	Drilling	Prod. in bbl.: Daily average	Accumulated to 7-1-52	Gravity, °A.P.I.	Geological data on prod. formation, age and lithology
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Centropozzi	1923			61				545,500		
Cortemaggiore[1]	1949	6,230	9		5	2	1,540	144,637	25	Miocene ss.
Ozzano			2	1				59,700		
Salominore	1925	500-1,600		3				40,800		
Vallezza[2]	1907	1,930	7	141	10		52	1,020,580	49	Oligocene ss.
Vizzola	1940	2,400	2	3			5	25,753		
Total Italy			20	209	15	2	[3]1,597	[3]1,846,970		

(1) Natural-gasoline and cycling plant, rated at 106 M.M.c.f. per day located in Cortemaggiore field. (2) Natural-gasoline plant located at Fornovo Taro. (3) Partly estimated.

Japan

The crude-oil-producing industry in Japan is maintaining total output without substantial change. The fields are small and are located mainly in northern Honshu. Geology of Japan seems to preclude the development of large-scale production in the country, although there are five sedimentary basins, other than northern Honshu, of possible interest from the standpoint of petroleum production.

Since the end of the war, production has been brought up to its present level in excess of 6,000 bbl. daily by intensive work with the assistance of United States technical personnel connected with the former occupation administration. Most important was the discovery of new deep reservoirs in Yabase field. This summer, Japan's first offshore oil discovery was reported off the coast of Akita Prefecture in northwestern Japan.

Virtually all the exploration and production in Japan is under control of Imperial Oil Co. which represents government capital and private Japanese interests.

JAPAN

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Hachimori										
Kakurazaka										
Narahashi										
Nishuyama										
Ybase										
Total Japan							[1]6,171	[2]2,258,600		

(1) Estimated. (2) On estimated basis for year ending June 30, 1952.

Kuwait

Further drilling in the Magwa extension to Kuwait's Burgan field during the last year has shown a substantial addition to this oil accumulation, the world's largest. The original Magwa discovery was completed the latter part of 1951, about 7 miles north of the north end of the field.

This small shaikhdom at the head of the Persian Gulf now ranks as the world's fifth largest oil-producing country, after the United States, Venezuela, Russia, and Saudi Arabia. Its highest production, through the first 9 months of this year, was approximately 810,000 bbl. daily in July.

The halt in operations in Iran placed a heavy burden on oil-handling facilities in Kuwait, and as a result these facilities have been considerably enlarged over the last 18 months. Potential production, considering the amount of crude that can be moved and shipped, is believed to be close to 1,000,000 bbl. daily.

The revised concession agreement with the Shaikh of Kuwait, signed on the 50-50 principle, is variously estimated at upwards of $125,000,000 per year. These funds are being used for an intensive improvement program for the Kuwait population, including construction of schools, hospitals, distillation plants, and other items.

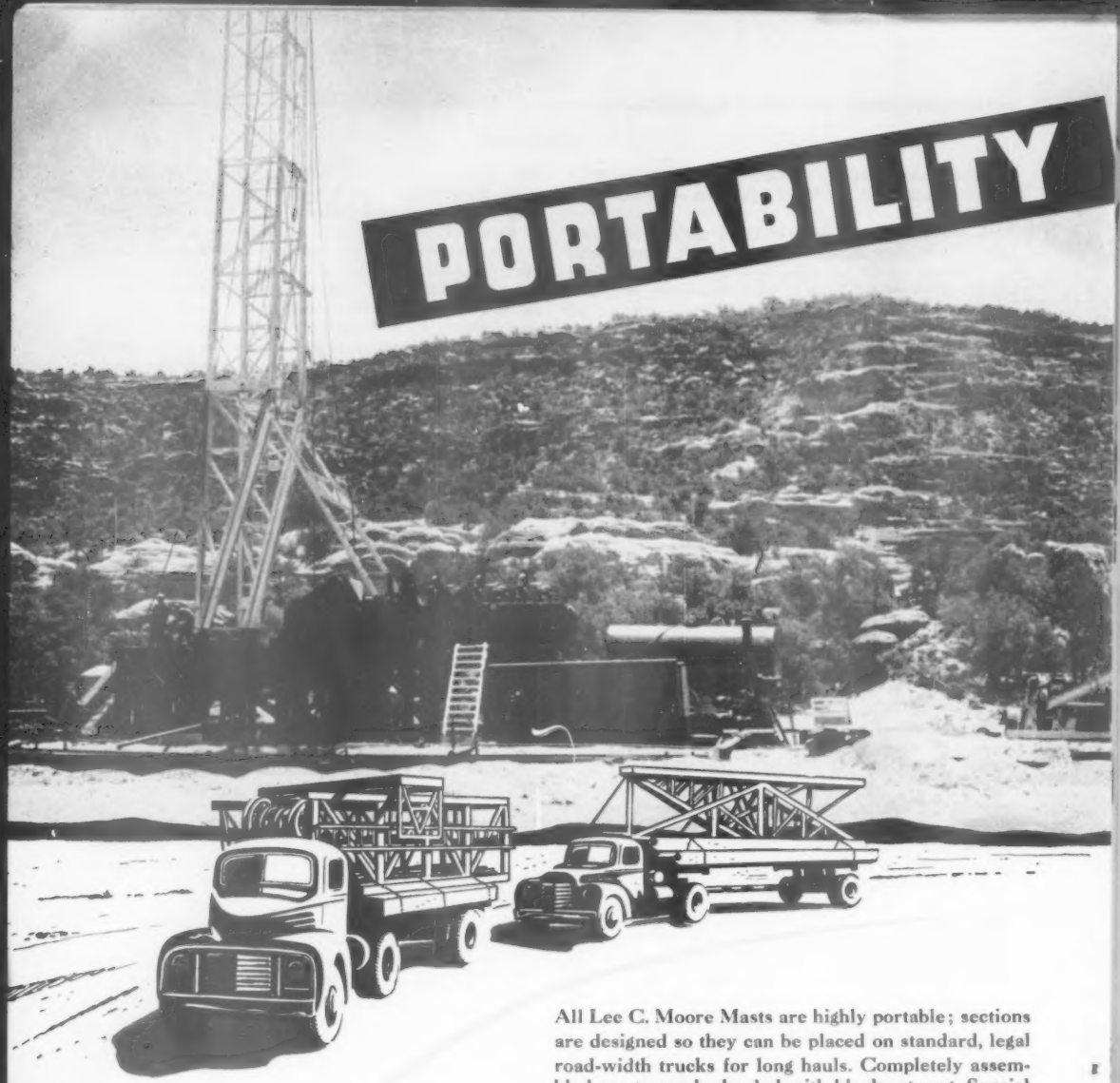
The Kuwait operation is conducted by Kuwait Oil Co., Ltd., owned 50-50 by Anglo-Iranian Oil Co., Ltd., and Gulf Oil Corp. K.O.C. has offices at 1 Great Cumberland Place, London W.1.

KUWAIT

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Burgan	1938	3,500-4,800	115		[1]12	3	740,700	624,071,789	32	Mid. Cretaceous ss.
Magwa	1952	4,300			2	1				Mid. Cretaceous ss.
Total Kuwait			115		14	4	740,700	624,071,789		

(1) Comprised of 4 observation wells and 8 other wells awaiting completion of gathering facilities.

PORTABILITY



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Mexico

The outstanding event in the Mexican oil industry during 1952 was discovery of an area which has been designated as Ezequiel Ordonez field. Officials of Petroleos Mexicanos describe the area as the country's most important oil discovery since 1931.

The new area is located about 20 miles from Poza Rica. The first well was completed August 24 with a production test of 8,050 bbl. daily. Pemex has moved aggressively to develop the area as rapidly as possible. Ten wells were scheduled for completion by the end of the year. Pemex officials were predicting production from the new field will reach 50,000 bbl. daily early in 1953.

Ezequiel Ordonez was a timely discovery. Poza Rica field, mainstay of Mexican oil production, has been cut back and repressuring work undertaken. Despite difficulties arising out of lack of dollar equipment, Pemex has made various other discoveries and extensions during the year but not of the apparent importance of Ezequiel Ordonez.

Of the several private companies operating under percentage-of-production contracts with Pemex, most important is Mexican American Independent Oil Co. (C.I.M.A.). This company is exploring structures in the Isthmus region and has discovered and developed Rabon Grande field and a gas field at Xicalango. It is owned in part by American Independent Oil Co. and has offices at 1-204 Reforma, Mexico City.

Head offices of Pemex are Av. Juarez, 92 and 94, Mexico City, D. F., Mexico. Its New York offices are at 74 Trinity Place, Suite 1900, New York 6.

MEXICO
Oil Fields

Name of field—	Year of discovery	Producing depth (ft.)	Number of wells: Flowing	Pumping	Shut in	Drilling	Prod. in bbl.: Daily average	Accumulated to 7-1-52	Gravity, °A.P.I.	Geological data on prod. formation, age and lithology
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Arroyo Blanco	1952	2,700	1				15	2,598		Miocene ss.
Cuichapa-Acalapa	1934	4,900	6	13	3	1	1,800	4,908,401	30	Miocene ss.
Ebano District	1901	2,600	525	14	181	11	23,410	834,669,464	12	Cretaceous ls.
El Burro	1930	5,400		28	13		985	18,740,382	26	Miocene ss.
El Plan	1930	8,000	36	61	82	3	13,382	82,463,881	23-27	Miocene ss.
Filisola	1921	3,600		39	42		810	22,374,084	22	Miocene ss.
Fortuna Nacional	1949	7,300	2		4		142	116,547	29	Miocene ss.
Francisco Cano	1949	5,800	7		1		847	539,713	45	Oligocene ss.
Jose Colomo	1951	4,500	6		2	1	775	263,702	29	Miocene ss.
Moloacan	1948	2,200	1	8	2		246	341,440	25	Miocene ss.
Monterrey[1]	1949	7,400	2		4	2	281	93,507	55	Oligocene ss.
Naranjos-Cerro Anzul Dist.	1908	2,600	266		84	7	21,572	1,117,578,581	20	Cretaceous ls.
Poza Rica Dist.	1930	8,500	130		37	19	141,502	494,308,324	30	Cretaceous ls.
Rabon Grande	1951	2,650	16		1	1	5,315	1,167,638	28	Miocene ss.
Reynosa[2]	1948	7,100	17		6	2	897	1,625,132	61	Oligocene ss.
Tepa Nuevo	1928	1,750		6	4		95	252,235	36	Miocene ss.
Tonala	1938	4,300		66	28		2,337	48,936,823	28	Miocene ss.
Tortuguero	1950	4,200			1			29,085	36	Miocene ss.
Trevino	1947	6,700	2			1	392	11,052	61	Oligocene ss.
Total Mexico oil fields			1,017	235	495	48	214,803	2,628,422,589		

(1) Produces small quantity of condensate. (2) See condensate production below.

Condensate Fields

Brasil	1948	8,000	6		1	2		2,610	55	Oligocene ss.
Mision	1945	8,050			4			108,879	58	Oligocene ss.
Reynosa[1]	1948	7,100	17		6	2	172	125,725	61	Oligocene ss.
Valadences	1948	6,200	1		1		2,519	18,329	61	Miocene ss.
Total Mexico cond. fields			24		12	4	2,691	255,543		
Total Mexico			1,041	235	507	52	217,494	2,628,678,132		

Netherlands

Although a fairly intensive drilling program over the last few years has failed to uncover additional oil resources in the Netherlands, a series of gas discoveries have been made. The single existing oil field, Schoonebeek, located in the eastern part of the country on the German border, has had its production stabilized at what presumably is the optimum rate of about 14,000 bbl. daily.

Natural gas has been found in wells at Gramsbergen, de Wijk, Wanneperveen, Ruinerwold, Tubbergen, and Staphorst. Plans are being made for the utilization of the gas, and there is considerable interest among industries in eastern Netherlands, especially textiles, in obtaining a supply of the fuel.

Concessions over a large area in the east central part of the Netherlands are held by N. V. Nederlandse Aardolie Mij., in which Standard Oil Co. (N. J.) and Royal Dutch-Shell participate on a 50-50 basis. The Shell organization is the operator for this joint-interest enterprise. The company is managed through N. V. De Bataafsche Petroleum Mij., Carel van Bylandtlaan 30, The Hague.

NETHERLANDS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Schoonebeek	1943	2,500		[1]163		2	13,570	22,110,370	25	Cretaceous sand

(1) Includes all producing wells in field.

Pakistan

The exploratory program conducted in Pakistan by the Burmah Oil Co., Ltd., organization resulted in a gas discovery the latter part of this year at Sui in Baluchistan in the western part of the country. The well was taken to a total depth of 10,049 ft., but failed to find oil. Other drilling is under way in the area.

B.O.C., through Pakistan Petroleum, Ltd., has been the most active wildcatting operator in East and West

Pakistan (continued)

Pakistan. United States interests have been reported discussing exploratory work, especially in East Pakistan, with the government. Pakistan Petroleum last spring began drilling a new test in the Patiya area of the Chittagong Hill Tracts in East Pakistan.

During the first half of this year, total Pakistan production amounted to about 3,700 bbl. daily. All this crude oil comes from four fields in the Punjab area of West Pakistan. Attock Oil Co., Ltd., produces about 3,000 bbl. daily of the total and has been seeking to extend this production by exploratory drilling and testing of deeper formations. Encouragement to this program has been given by discovery of a new producing formation at about 8,300 ft. in Dhulian field. Pakistan Petroleum also has production near Balkassar, one of the Punjab fields.

B.O.C., with which Pakistan Petroleum is affiliated, has offices in Britannic House, Finsbury Circus, London E.C.2. Attock Oil offices at Rawalpindi.

PAKISTAN

Name of field—	Year of discovery	Producing depth (ft.)	Number of wells: Flowing	Pumping	Shut in	Drilling	Prod. in. bbl.: Daily average	Accumulated to 7-1-52	Gravity, °A.P.I.	Geological data on prod. formation, age and lithology
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Balkassar	1946	8,200	6	....	3	1	3,300	[1]1,400,000	28	Eocene ls.
Dhulian	1937	7,600-8,300	21	....	....	1	700	.....	35	Eocene ls.
Joya Mair	1944	7,000	1	....	1	....	300	.....	22	Eocene ls.
Khaur[2]	1915	.....	....	....	....	....	35	.....	37	U. Tertiary ss.
Total Pakistan			28	....	4	2	4,335	1,400,000		

(1) Exclusive of Attock Oil Co., Ltd., operations. Figure is that reported by The Burmah Oil Co., Ltd. (2) Stripper field.

Peru

An exploratory boom is shaping up in this Latin-American republic. Late in October, the Peruvian Government began accepting applications for concessions from foreign companies under terms of a new petroleum law.

Thirteen separate companies asked for acreage in a concession filing rush that surprised some industry officials who earlier had thought the stiff tax features of the new law would discourage operations. Since most of the applied-for acreage involves duplications, much of it will be awarded in the auction procedure provided for in the law.

The area of the greatest interest is the Sechura Desert region in the coastal zone. Little interest was shown in the mountain and transmountain regions where operators developing large-scale production would be faced with the necessity of constructing an expensive pipe line.

The prospect of new, intensive exploratory work in Peru is a timely development. Petroleum consumption in the country is rising rapidly, but production by contrast has been only slightly expanded even with considerable drilling. The major operator is International Petroleum Co., Ltd. (Standard Oil Co., [N. J.]), which produces about three-fourths of the Peruvian total from its fee-owned La Brea-Parinas Estate property. Some additional production has been developed in recent years by drilling in the so-called strip area between International's property and the holdings of the second most important Peruvian company, Cia. Petrolera Lobitos.

Applicants for new concessions in Peru include United States, Canadian, Argentine, and Peruvian companies. The United States companies are: International, which has headquarters at 396 Alhambras Circle, Coral Gables, Fla.; Conorado Petroleum Corp., 630 Fifth Ave., New York; Gulf Oil Corp., whose program is handled through its foreign division, 17 Battery Place, New York; and Richmond Petroleum Co. of California (Standard Oil Co. of California), 200 Bush Street, San Francisco. All these companies have local offices in Lima. Cia. Lobitos is affiliated with Lobitos Oilfields, Ltd., 146 Dashwood House, Old Broad Street, London E.C.2.

PERU

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Agua Caliente	1938	1,200	5	1			[2]500	[2]1,108,000	34	Cretaceous ss.
Cope	1938	650		6			19	124,135	35	Miocene ss.
La Brea-Parinas	1888	500-7,000	218	1,665		7	31,000	340,600,000	34-38	Eocene ss.
Lobitos[1]	1905	2,500-4,000		1,072		18	8,900	[2]78,300,000	37	Eocene ss.
Los Organos	1943	2,000	1	43		5	1,000	1,061,489	42	Eocene ss.
Zorritos	1863	2,000		25			36	3,599,632	37	Miocene ss.
Total Peru			224	2,809		30	41,455	424,793,256		

(1) Includes El Alto, Restin and Organos. (2) Estimated.

Qatar

Petroleum Development (Qatar), Ltd., has made a southerly extension to Dukhan field, and work has been under way on facilities to permit additional production from this Persian Gulf shaikhdom. New separator and pumping facilities have been built halfway between Dukhan and Umm Bad, and at Umm Said on the eastern side of the peninsula where a pipe-line terminal is located. Residential and industrial buildings are being constructed in a development plan to make this point the headquarters of the operating company. Petroleum Development (Qatar) is associated with Iraq Petroleum Co., Ltd., 214 Oxford Street, Oxford Circus, London W 1.

Another development of considerable interest in connection with Qatar was acquisition early in the year of the Qatar offshore oil concession by Royal Dutch-Shell. Rights in this submerged territory, consisting generally of that lying beyond the 3-mile limit, earlier were relinquished by International Marine Oil Co., Ltd., in which Superior Oil Co. held a controlling interest. The Superior company had done geophysical work in the area but no drilling. A similar offshore concession in the Trucial Coast shaikhdom of Abu Dhabi was by International Marine and subsequently taken up by the Shell organization.

QATAR

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Dukhan	1940	6,000	15		9	2	67,500	43,077,000	39	Jurassic ls.

Saudi Arabia

The greater part of Arabian American Oil Co.'s drilling program in its Saudi Arabian concession is concerned with development of Uthmaniyah field which was discovered in 1951 with a successful wildcat about 20 miles west of Hofuf. At the same time, production from the Ain Dar area to the north has been used increasingly to allow reduction in the output of Abqaiq field where a major pressure-maintenance program is starting.

Uthmaniyah is scheduled to go on commercial production the first part of 1953. By midyear, the company had finished construction of a new 53-mile, 30 and 31-in. line from Uthmaniyah to Abqaiq. The line was first used on a temporary basis for delivery of water by gravity flow, and then placed in its intended oil use by a connection into the southern separator station of Ain Dar field.

In early January, Saudi Arabia passed a milestone in its petroleum history when the billionth barrel of crude oil was produced by Aramco. The event followed 14 years of production and 5 years of previous exploratory effort.

Aramco continues to carry out exploratory work in line with the terms of its concession. For the last 2 years, the program has been concentrated in the desolate, waterless Rub-al Khali, or "Empty Quarter" in southeastern Saudi Arabia. Other developments in 1952 in Saudi Arabia included completion of two additional separator stations in Qatif field and the beginning of operations at a station on the main 30-31-in. line which is designed for unattended operation.

Aramco has its headquarters at Dhahran in Saudi Arabia. Its New York offices are at 505 Park Avenue.

SAUDI ARABIA

Name of field—	Year of discovery	Producing depth (ft.)	Number of wells: Flowing	Pumping	Shut in	Drilling	Prod. in bbl.: Daily average	Accumulated to 7-1-52	Gravity, °A.P.I.	Geological data on prod. formation, age and lithology
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Abqaiq	1941	6,800	62		1		463,485	751,793,851	38	Jurassic ls.
Abu Hadriya	1940	10,115			1			9,579	36	Jurassic ls.
Ain Dar	1948	7,125	30		11	3	297,604	110,356,231	35	Jurassic ls.
Dammam	1936	4,850	23		4		63,000	262,714,351	35	Jurassic ls.
Fadhili	1949	9,850			1				38	Jurassic ls.
Haradh	1949	6,550			6				34	Jurassic ls.
Qatif	1945	7,350	9				34,084	27,959,106	35	Jurassic ls.
Safaniya	1951	5,560			6	1			27	Cretaceous ss.
Uthmaniyah	1951	6,875			10	4			34	Jurassic ls.
Total Saudi Arabia			124		40	8	858,233	1,152,833,118		

Trinidad

Trinidad is maintaining its production rate and reserves position largely by continued intensive development of known fields. The most productive field is Forrest Reserve. Here, the operator, Trinidad Leaseholds, Ltd., has in service three pressure-maintenance plants, which are expected to improve considerably the field's ultimate recovery. Better pumping facilities are allowing production to be held in some of the smaller fields.

The bulk of production on Trinidad is from companies representing British interests. Of considerable interest was the establishment in 1952 of a new West Indies exploration subsidiary by Standard Oil Co. of California. The company, Dominion Oil Co., Ltd., set up headquarters in Port of Spain and acquired or applied for approximately 700,000 acres.

Prospect of offshore production in the Gulf of Paria holds the attention of several of the Trinidad operators. In 1951, a directional well on the beach near La Brea found offshore production, and drilling from over-water platforms was planned. Prospects of finding production in the Gulf of Paria has long been considered promising.

Trinidad Leaseholds, Ltd., has local offices at Pointe-a-Pierre, Trinidad, and London offices in Trinidad House, 29-30 Old Burlington Street, London W 1. Other Trinidad companies include Antilles Petroleum Co. (Trinidad), Ltd., Box 31, San Fernando, Trinidad; Apex (Trinidad) Oilfields, Ltd., 208-224 Salisbury House, London Wall, London E. C. 1; Kern Trinidad Oilfields, Ltd., Box 55, San Fernando; United British Oilfields of Trinidad, Ltd., Shell House 15, Abercromby Street, Port of Spain; and Trinidad Petroleum Development Co., Ltd., Siparia, Palo Seco, Trinidad.

TRINIDAD

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Barrackkpore	1918	500-10,000	14	36		1	1,200	8,658,500	30	Mio., Olig. ss.
Brighton-Vessigny	1909	700-4,600	46	54		2	1,700	8,996,100	30	Mio., Olig. ss.
Coora	1936	170-8,550	37	70		2	2,900	19,691,200	37	Miocene
Cruse	1913	1,800-4,000	18	90		1	1,850	17,516,200	30	Miocene
Erin	1948	3,160-3,640	1				20	42,400	28	Miocene
Forrest Reserve	1914	100-8,000	102	333		3	14,100	108,970,800	24	Miocene ss.
Fyzabad	1920	300-8,000	59	242		4	8,400	93,278,300	34	Miocene ss.
Guapo	1921	1,500-5,700	39	93		1	2,300	15,923,800	17	Miocene ss.
Guayaguayare	1902	500-6,000	7	62		1	1,160	9,872,700	29	Miocene ss.
Los Bajos	1937	490-6,060		13			100	3,353,500	23	Miocene ss.
Mackenzie	1947	6,200-6,630	2	1			100	116,900	30	Miocene
Mandingo	1948	3,150-3,560	1				10	18,900	41	Oligocene ss.
Morne Diablo	1936	1,000-4,700	3	19			350	2,640,200	33	Miocene ss.
New Dome		1,000-2,500		9			70	2,382,300	26	Miocene
Palo Seco	1927	400-6,400	49	131		2	3,500	26,083,600	28	Miocene
Parrylands	1913	2,000-4,000	48	40					26	Miocene
Penal	1935	1,300-9,870	31	89	6	3	6,400	21,359,000	23	Mio., Olig.
Point Fortin	1908	1,000-7,825	193	152	26	2	8,000	67,304,500	20	Miocene
Quarry	1938	285-6,488	26	54		1	2,900	11,793,500	33	Miocene
Quinam	1936	1,000-4,300	3	12		1	300	1,544,000	34	Miocene ss.
San Francique	1922	1,000-2,800	1	17			250	4,945,400	23	Miocene ss.
Sunty	1951		1				10	6,100		
Wilson	1918	500-3,500	3	38		1	1,200	4,630,000	25	Mio., Olig. ss.
Total Trinidad			684	1,555	32	25	[1]56,820	[1]429,127,900		

(1) Estimated for first 6 months of 1952.

Turkey

Full production potential of Ramandag field in southeastern Turkey is rated at around 5,000 bbl. daily, although actual production is currently only about one-fifth of this figure. About half the actual output is processed in a small topping plant, and the remainder is burned as fuel by state railways.

Near the Ramandag area is Garzan where two of the three wells drilled have been productive. Ramandag field itself is produced from three of the nine wells that have been drilled. Turkish officials for some time have been studying a plan for construction of a refinery which would provide an outlet for much larger production.

Oil operations in Turkey are under control of the government's Mining Research and Exploration Institute (Maden Tetkik ve Arama Enstitusu) which has headquarters in Ankara. This organization has been carrying out a program of exploratory drilling elsewhere in the country, including the Cengan District near the port of Iskenderun where results have been reported as highly encouraging. Foreign interests from time to time have shown an interest in Turkish operations, but nothing definite has materialized pending clarification of Turkish law.

TURKEY

Name of field—	Year of discovery	Producing depth (ft.)	Number of wells: Flowing	Pumping	Shut in	Drilling	Prod. in bbl.: Daily average	Accumulated to 7-1-52	Gravity, °A.P.I.	Geological data on prod. formation, age and lithology
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Garzan	1951	5,000			3	2			26	Cretaceous ls.
Ramandag	1948	4,000		3	6	2	1,000	350,000	20	Cretaceous ls.
Total Turkey				3	9	4	1,000	350,000		

United Kingdom

Latest effort in continued exploratory work by the Anglo-Iranian Oil Co., Ltd., organization in the United Kingdom is a wildcat well which was commenced in mid-October on the Isle of Wight. The test, being drilled in approximately the center of the island, is to be taken to about 8,000 ft. Last spring, seismograph work was begun in the area east of Nottingham by A.I.O.C. personnel. At Formby, additional shallow field wells have indicated the possibility of further small-scale development.

A.I.O.C. operates the five existing United Kingdom fields and carries on the exploratory program through its subsidiary, D'Arcy Exploration Co., Ltd. Production has been maintained with the help of secondary-recovery operations. Though Britain's chances of becoming an important oil producer appear poor, the work which has been carried out has resulted in the discovery of other minerals, particularly potash and coal, and holds the possibility of small-scale expansion of the oil production. The D'Arcy company is headquartered with Anglo-Iranian in Britannic House, Finsbury Circus, London E.C. 2.

UNITED KINGDOM

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Caunton	1943	2,000-2,200		10	1		20	184,000	29	Carboniferous
Dukes Wood	1941	1,800-2,500		113	3		470	2,456,000	34	Carboniferous
Eakring	1939	1,800-2,500		49	4		310	1,548,000	34	Carboniferous
Formby	1939	85-130		8			5	65,000	34	Keuper ss.
Kelham Hills	1941	2,000-2,200		48	4		350	1,071,000	29	Carboniferous
Total United Kingdom				228	12		1,155	5,324,000		

U. S. S. R.

Virtually the only information publicly available on oil production in U.S.S.R. comes from occasional announcement made by Russian authorities. In the past these have usually been couched in vague terms of percentage gain or percentage fulfillment of production goals.

The first official disclosure of exact Russian production figures in several years was made this fall in a speech by Georgi M. Malenkov, high Communist Party official. He said Soviet oil production this year will amount to 47,000,000 metric tons or about 935,000 bbl. daily.

The figure was in line with the estimates that had been made outside Russia. Malenkov's speech was made at the All Union Communist Party Congress, and at the same meeting, data were made public on industrial production plans which reflected the prime importance Russia places on petroleum. The 1955 goal calls for production of about 1,385,000 bbl. daily, which means that output must be raised by some 120,000 bbl. daily annually the next 3 years.

Available information indicates that the Russians have less success in developing production in Eastern Europe other than in the Soviet occupation zone of Austria. The Romanian industry, nationalized and Communist controlled as is the case elsewhere in the satellite area, is believed to be in difficulties arising out of management troubles and shortages of essential equipment. Similar conditions plague Hungary's oil operations. On the other hand, in Austria, the Soviet Mineral Oil Administration has developed production estimated to amount to 45,000 bbl. daily or more.

U.S.S.R. AND SATELLITE COUNTRIES

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Austria							42,570			
Romania							89,900			
Russia							859,020			
Other							28,210			
Accum. total prod. for Russia and satellites to July 1, 1951								8,821,646,000		

(1) Official information on production operations in Russia and its satellite countries is not available. Figures reported here are current estimates.

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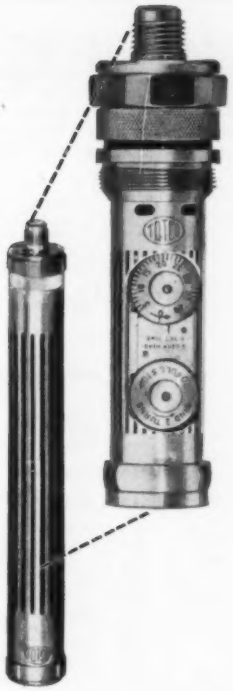

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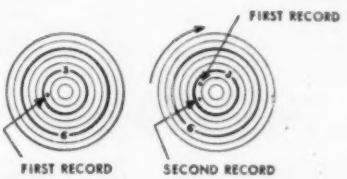

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Venezuela

Of the 12 producing companies in Venezuela, more than 90 per cent of the country's total output is by the three leading operators: Creole Petroleum Corp., Apartado 889, Caracas, D.F., and 350 Fifth Avenue, New York; Shell, Apartado 809, Caracas and 50 West Fiftieth Street, New York; and Mene Grande Oil Co., Apartado 709, Caracas. Shell is represented in Venezuela by three companies, Shell Caribbean Petroleum Co., Ltd., Colon Development Co., Ltd., and Venezuelan Oil Concessions, Ltd. Creole is an affiliate of Standard Oil Co. (N. J.), Mene Grande is controlled by Gulf Oil Corp, with home office in Pittsburgh.

Eastern

Name of field—	Year of discovery	Producing depth (ft.)	Number of wells				Prod. in. bbl.			Geological data on prod. formation, age and lithology
			Flowing	Pumping	Shut in	Drilling	Daily average	Accumulated to 7-1-52	Gravity, °A.P.I.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Apamate	1951	6,670	1				369	124,934	40	Miocene ss.
Aragua	1950	9,000	13		1	1	4,859	1,308,016	54	Oligocene ss.
Boca	1951	9,500	27		6	5	20,085	3,513,282	31	Miocene ss.
Caico Seco	1946	6,500-7,300	10		18	3	3,503	1,683,214		
Cantaura	1952	10,630	1				205	7,409	42	Mio., Olig. ss.
Cerro Pelado	1951	4,400	1		2		159	19,467	39	Miocene ss.
Chimire	1948	7,200	108		49	1	45,561	51,823,617	36	Mio., Olig. ss.
Dacion	1951	6,700	53	1	8	1	17,302	7,426,513	25	Mio., Olig. ss.
El Roble	1939	8,000-11,560	25		3	1	3,407	21,505,934	55	Mio., Olig. ss.
El Toco	1948	9,000	10		6	1	3,815	3,329,646	41	Eocene ss.
Esquina	1951	4,360	2		1		899	115,090	45	Mio., Olig. ss.
Fria	1948	6,500-7,300	11	4	3		3,144	1,595,378	38	Mio., Olig. ss.
Guara	1942	5,000-10,000	153	48	71	1	54,801	185,290,774	36	Mio., Olig. ss.
Guario	1940	5,000-10,000	21	2	19		7,728	17,057,481	44	Mio., Olig. ss.
Guere	1951	7,800	13			6	3,955	1,562,161	38	Miocene ss.
Guico	1944	4,500-7,000	25	24	17		9,151	35,108,275	39	Miocene ss.
Inca	1948	7,100	2		4		214	364,656	40	Mio., Olig. ss.
Jusepin	1938	3,000-5,300	146	55	231		16,370	138,063,155	32	Mio., Olig. ss.
La Vieja	1951	2,570	9		5	1	1,486	322,905	23	Oligocene ss.
Las Mercedes[1]	1941	4,160-4,500	149	46	112	3	25,440	28,240,414	32	Oligocene ss.
Leona	1938	8,000	24	13	24	1	6,330	16,420,314	28	Mio., Olig. ss.
Los Mangos	1950	8,100			1			117,675	35	Miocene ss.
Mata	1951	11,520	2			2	721	31,908	32	Mio., Olig. ss.
Mata Grande	1946	4,700	10	11	17	1	1,349	2,915,823	28	Miocene ss.
Merey	1937	5,700	4	3	6	1	1,565	735,583	19	Pleistocene ss.
Mulata	1941	3,500-6,600	74	83	75		11,183	66,415,014	36	Miocene ss.
Muri	1942	4,500	8	40	11		1,582	13,285,047	27	Miocene ss.
Nipa	1945	6,000-8,500	106	15	45	1	33,624	60,055,694	35	Miocene ss.
Oficina	1937	5,980	147	142	130	3	63,679	201,698,759	35	Mio., Olig. ss.
Pedernales	1933	1,571	19		18	1	10,244	22,360,023	21	Miocene ss.
Pelayo	1947	7,400			7			245,811	30	Oligocene ss.
Pradera	1951	6,430	1		1		510	64,955	28	Mio., Olig. ss.
Quiamare	1942	5,900-6,650	1		1	2	147	723,004	39	Miocene ss.
Quiriquire	1928	6,500-8,000	4	434	119	7	72,532	390,847,086	17	Pliocene ss.
Rincon Largo	1941	6,500-8,000	4			1	1,251	5,221,574	43	Mio., Olig. ss.
Ruiz	1949	4,450	52	10	13		8,674	7,215,906	31	Oligocene ss.
Saban	1947	2,600	17	6	52	1	3,458	911,829	28	Oligocene ss.
San Joaquin	1939	6,560	38	3	23	2	9,932	37,220,603	44	Miocene ss.
San Roque[2]	1949	8,500	22		6	1	3,823	5,321,707	54	Oligocene ss.
Santa Ana	1936	8,500	17		6	3	8,559	6,928,859	39	Oligocene ss.
Santa Barbara	1941	5,000-6,500	71	40	26		10,998	74,799,448	32	Mio., Olig. ss.
Santa Rosa	1941	8,500	17		6	1	5,631	9,664,568	44	Mio., Olig. ss.
Soto	1949	9,500	38		11	7	24,967	8,154,769	31	Miocene ss.
Taman	1949	5,200	10	9	10		3,215	6,100,206	39	Miocene ss.
Tagua	1950	7,800	1				53	30,449	38	Miocene ss.
Tapuco	1952	10,100	3			3	700	21,002	22	Miocene ss.
Temblador	1936	3,500-4,500	79		50		8,463	40,045,274	15	Mio., Olig. ss.
Travieso	1944	4,000		9	2		201	1,075,446	27	Miocene ss.
Tucupido	1947	2,800-5,600	24	3	45		3,212	8,696,105	40	Mio., Olig. ss.
Tucupita	1945	5,600	43		6		10,539	14,504,371	16	Mio., Olig. ss.
Yopales	1937	4,600	8	10	14		4,114	5,632,404	27	Mio., Olig. ss.
Others[3]					30	8		2,736,048		
Total Eastern Venezuela			1,624	1,011	1,311	70	533,709	1,508,660,585		

(1) Includes Guavinita and Palacio fields. (2) Includes La Loma field. (3) Includes Areo, Chaparro and Tabasco, Chive, Dakoa, El Chaparro, Freites and Guanoco, Grico, La Ceiba, Las Ollas, Socororo, fields.

Western

Bachaquero	1930	3,444	634	472	230	9	225,351	306,237,771	14	Miocene sand
Boscan	1946	6,500-7,500		56	16	2	20,315	14,219,526	10	Eocene ss.
Cabimas	1917	2,200	164	767	697	2	93,649	687,345,158	25	Mio., Olig. ss.
Concessiones Lacustres	1948	8,000	3		2		1,018	672,610	34	Eocene ss.
Cumarebo	1913	1,968	14	33	87	1	4,222	44,324,922	47	Miocene ss.
El Cubo[1]	1916	984	24	105	124	2	17,738	121,735,753	33	Eocene, Cret. ls., ss.
Ensenada	1948	8,550	1	-	3	1	596	250,610	57	Tertiary ss.
Hombre Pintado	1927	600-1,850		26	32		487	4,986,663	25	Miocene ss.
La Concepcion	1935	3,148	3	70	79	1	3,130	36,927,556	36	Eocene ss.
Lagunillas	1926	3,000	396	1,194	593	5	424,087	2,138,751,641	25	Mio., Olig. ss.
La Paz	1925	4,264	20	49	66	4	139,775	296,401,046	34	Eocene, Cret. ls., ss.
Mara	1945	5,248	26	7	45	6	73,456	125,514,547	30	Cretaceous ls.
Mene de Mauroa	1921	1,000		29	317	1	424	25,207,904	33	Nur. ss.
Mene Grande	1914	4,132	5	387	293	2	46,861	380,256,462	18	Eocene ss.
Pueblo Viejo	1940	1,968	6	12	17	1	2,770	13,104,593	19	Eocene ss.
Sibucara	1948	13,451	2		5	2	9,138	10,260,367	36	Cretaceous ls.
Tia Juana	1928	3,000	190	732	250	2	226,663	775,654,399	27	Eo., Mio., Olig. ss., s.
Others[2]					132	4		2,089,987		
Total Western Venezuela			1,488	3,939	2,988	45	1,289,680	4,983,941,515		
Total Venezuela[3]			3,112	4,950	4,299	115	1,823,389	6,492,602,100		

(1) Includes Los Cruces, Los Manueles, West Tarra fields. (2) Includes Acosta, Albaricos, Alturitas, Amana, Buchivacoa, El Menito, Las Palmas, Mene, Mene de Acosta, Netick, Quiroz, San Jose fields. (3) From government reports.

Journal's International

SURVEY OF OIL REFINERIES

by R. B. Tuttle
Associate Editor

CRUDE-OIL input capacity, on a basis of total world refining, is now nearing 14,000,000 bbl. daily. During 1953, world-wide refining capacity, outside of the United States and exclusive of Russia and its satellite countries, is scheduled to rise to 5,527,000 bbl. per day. This increase amounts to more than 500,000 bbl. per day above the previous year's figure.

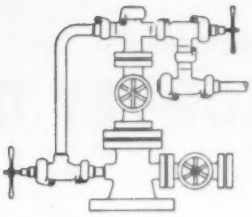
By 1954, free-world countries outside of the United States are scheduled for refinery capacity boosts totaling around 350,000 bbl. daily. A number of the projects contributing to this increase are now under way. Included as major projects now under construction for 1954 completion are 12 new refineries. These projects total about 200,000 bbl. per day. Expansion of existing refineries makes up the remaining new capacity of approximately 150,000 bbl. per day that is to be added in 1954.

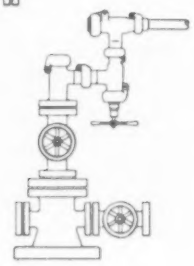
Summary of World Refineries

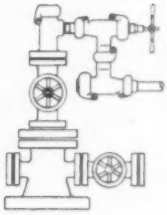
Area and countries—	No. of oper. ref.	Cap., 1,000 bbl. per day: Crude-oil dist.	Thermal proc.	Catalytic proc.
N. and S. America:				
Argentina*	16	172.1	63.9	
Bolivia	4	10.9		
Brazil	4	12.3	4.5	
Canada	36	450.5	149.3	112.3
Colombia	2	28.8		
Cuba	2	5.7	1.4	
Ecuador*	2	5.7		
Mexico	8	223.0	31.0	
Netherlands W. I.	3	670.0	393.0	37.0
Peru	3	38.3	3.0	
Trinidad	3	120.0	32.0	15.0
United States	329	7,340.3	2,235.2	2,191.9
Uruguay	1	25.2	2.2	
Venezuela	13	417.7	88.0	
Total	426	9,520.5	3,003.5	2,356.2
Europe and Africa:				
Austria†‡	1	2.2		
Belgium	7	113.9	42.2	8.0
Canary Islands	1	27.0	3.7	
Denmark	3	.9		
Egypt	2	50.0	6.4	
France	13	456.4	70.5	35.3
French Morocco	1	2.1		
Germany	22	140.5	11.3	33.1
Italy	17	257.5	31.9	19.6
Netherlands	2	195.5	41.4	25.0
Norway	1	1.0		
Portugal	1	10.0		
Spain	2	30.7	8.2	
Sweden	3	34.8	7.3	
Switzerland	1	4.0	1.0	
United Kingdom	12	540.8	41.9	96.0
Total	89	1,867.3	265.8	217.0
Middle East:				
Bahrein	1	155.0	35.2	21.3
Iran§	2	502.5	75.0	25.0
Iraq	2	9.5		
Israel	1	85.5	36.4	
Kuwait	1	30.0		
Lebanon	1	100.0		
Saudi Arabia	1	210.0	24.5	
Turkey§	1	1.4		
Total	10	1,093.9	171.1	46.3
Other Asia and Oceania:				
Australia	4	19.5		1.5
Burma	1	3.0		
Formosa*	1	15.0	2.0	
India	1	5.8	1.5	
Indonesia	6	242.1	56.0	
Japan¶	13	89.5	7.9	8.6
Pakistan	1	4.3		
Total	27	379.2	67.4	10.1
Total world excl. U.S.S.R. and Communist areas	552	12,860.9	3,507.8	2,629.6
U.S.S.R. and Communist areas:*				
Albania	3	1.6		
Austria	7	21.1	.8	
Bulgaria	3	2.2		
China	1	2.0		
Czechoslovakia	7	13.6	2.7	
Hungary	8	22.2		
Poland	6	8.4		
Romania	15	154.0	36.8	
U.S.S.R.	29	875.0	250.0	50.0
Yugoslavia	5	8.0		
Total	84	1,108.1	290.3	50.0
Total world	636	13,969.0	3,798.1	2,679.6

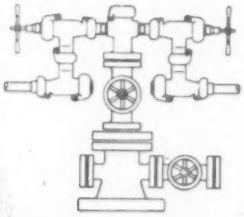
*Estimated. †See U.S.S.R. and Communist areas for other Austrian refineries. ‡Idle capacity. §Only small portion of capacity currently utilized. ¶Partly estimated.

Any way you look at it... by any standard









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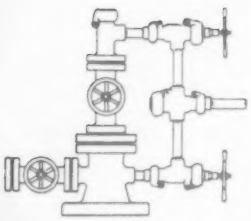

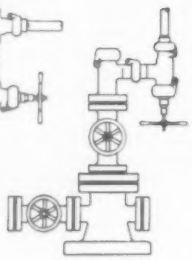

Ask your Christmas tree supplier to furnish UNIBOLT Flow Manifolds (everything above the master valve). These compact, completely salvageable manifolds, consisting of a Tee or Cross, Adjustable Wing Valve, and Positive Choke Body, are pressure-tested as a unit and may be assembled in a number of combinations to best meet individual needs.

Employing standard UNIBOLT connections rather than flanges, the UNIBOLT Flow Manifold is many pounds lighter, yet the UNIBOLT design, which places more metal in shear, actually results in a higher factor of safety for the manifold.

Furnished in regular forged steel or in high-chrome alloy for corrosive wells — 6000, 10,000 and 15,000 lbs. test.

THORNHILL-CRAVER COMPANY

P. O. BOX 1184 HOUSTON, TEXAS

UNIBOLT

The current program for expanding free-world refining capacity is scheduled into 1956. Plans for the 1955-1956 period outside of the United States call for eight new refineries totaling more than 150,000 bbl. per day of input rating. One of these projects, a new 40,000-bbl. per day plant in India, is just being started. The others are expected to get under way within a short time.

Apart from new refineries, modernization of existing plants and increases in their capacities is currently being scheduled as far ahead as 1956. These projects are estimated to involve another 150,000 bbl. per day of crude-oil input capacity for the free-world countries outside of the United States.

Now in the early planning stages are projects for installation of refineries in countries where the entire petroleum products demand is now being met by imports. Known to be definitely under study are projects for Kenya, Aden, and Puerto Rico.

Within the next 3½ to 4 years, free-world refining capacity outside of the United States is scheduled to rise to 1,000,000 bbl. daily. This figure is believed to be still below capacity needed to meet projected demand on refined products 4 to 5 years from now.

World-wide yield patterns have changed appreciably over the past few years in the free countries outside of the United States. Except for some wartime-built refineries, catalytic cracking and similar facilities did not enter into the processing scheme of the normal refinery in these countries until after 1948. Today, nearly 500,000 bbl. per day of catalytic operations is installed in these refineries.

By the end of 1954 many of the free world's refineries outside of the United States are scheduled to be equipped with catalytic facilities. Apart from catalytic equipment being installed in new refineries, there are about 20 current projects covering installation of cat processes in existing plants. Combined rating of these new facilities is approximately 120,000 bbl. daily. By 1956 an additional 100,000 bbl. of cat capacity is expected.

The free world's refining capacity for the next few years is indicated to be still inadequate to meet demands as to both quality and quantity. Reliable demand projections show that the industry may not even narrow the present breach between production and over-all demand by 1955.

Expansion of world-wide refining facilities, in 1956 and later, is definitely on the agenda of all operating companies. Some projects are even now in the preliminary planning stages and may receive authorization as early as 1953. Others may not reach that phase until as late as late as 1955.

ALBANIA

Company and address—	Refinery location	Type of plant	Charging capacity, bbl. per day: Crude oil	Thermal operations	Catalytic operations
State Owned Refineries	Kocova	S-A	[1]1,600	.....	.....

(1) Total estimated capacity for three small plants. A fourth refinery rated at 2,740 bbl. per day is being built near Cerrick. Completion is expected in 1955.

ARGENTINA

Cia. Condor, Levalle 27, Avellaneda	Avellaneda	S	900	.....	.....
Cia. General Asfaltos, Buenos Aires	Buenos Aires	S	400	.....	.....
Cia. La Isura, S. A., Ave. Pte. R. S. Pena 609, Buenos Aires	Bahia Blanca	S-C	2,000	1,000	.....
Diadema Argentina, S. A., de Petroleo, Roque 788, Saenz Pena, Buenos Aires	Buenos Aires	S-C	18,000	12,000	.....
Esso Refinadora de Petroleo, S. A., Avenda Roque Saenz Pena 567, Buenos Aires	Bahia Blanca	S-C-A	5,500	2,200	.....
	Campana	Comp.	22,500	10,000	.....
	Dadin	S	400	.....	.....
	Manuel Elordi	S	1,250	.....	.....
Lottero y Papinia, Avellaneda	Avellaneda	S	300	.....	.....
Ultramar, S. A., Petrolera Argentina, Av. Alem 619, Buenos Aires	Avellaneda	S-C	6,000	2,500	.....
Yacimientos Petroliferos Fiscales, Av. Roque Saenz Pena 777, Buenos Aires	Buenos Aires	S-C	5,500	2,000	.....
	La Plata	S-C	85,000	25,000	.....
	Lujan de Cuyo	S-C	5,000	3,000	.....
	Plaza Huincul	S	1,300	.....	.....
	Salta	S	2,000	.....	.....
	San Lorenzo	S-C	16,000	6,200	.....
Total Argentina[1]			172,050	63,200	.....

(1) Estimated.

Australia

Australia's current consumption of petroleum products is approximately five times as great as its refining capacity. Within the next 3 or 4 years refining capacity is expected to be in balance with demand even though Australia's demand for petroleum products may rise above 100,000 bbl. daily by 1956.

Completion schedules on new plants and expansion of facilities in existing Australian refineries indicate substantial capacity increases will be made available in 1954 and 1955. These projects, now under way, will give Australia a total refining capacity of about 60,000 bbl. per day. In addition to this increase another 60,000-bbl. per day refinery is projected for 1956. This installation is slated for Australia's west coast area at Fremantle by Anglo-Iranian Oil Co., Ltd.

Catalytic cracking capacity for Australian refineries is scheduled to rise to 15,000 bbl. daily by 1954. More capacity is to be added in 1955 and the new plant projected by Anglo-Iranian Oil Co., Ltd., is scheduled to boost the capacity again in 1956. Currently, only one refinery in Australia is equipped with catalytic processing facilities.

AUSTRALIA

Australian Oil Refining, Pty., Ltd., Sydney	Kurnell	(1)	.....	.....	.....
Bitumen & Oil Refineries (Australia), Ltd., P.O. Box 1, Matraville	Matraville	S-A	6,500	.....	[2]1,500
Commonwealth Oil Refineries, Ltd., Scottish House, 90 William St., Melbourne	Laverton	S	2,850	.....	.....

AUSTRALIA (Continued)

Company and address—	Refinery location	Type of plant	Charging capacity, bbl. per day: Crude oil	Thermal operations	Catalytic operations
The Shell Co. of Australia, Ltd., Shell Corner, 163 William St., Melbourne	Clyde	S-L-A	8,400		
	Geelong	(1)			
Standard-Vacuum Refining Co., Ltd., P.O. Box 4054, G.P.O., Melbourne	Altona	S-L-A	[4]1,800		(5)
Total Australia			19,550		1,500

(1) New refinery with 22,000 bbl. per day crude-oil and 13,333 bbl. per day catalytic cracking capacities. Plant to be completed in 1954. (2) Platforming operation. (3) Lube-oil refinery under construction. (4) Capacity to be increased to 20,000 bbl. per day in 1955. (5) Catalytic reformer and cracker to be added in 1955.

AUSTRIA

Western Zone					
Deutsche Erdoelwerke, A. G.	Ebensee	S-L	[1]2,200		
Soviet Zone					
A. G. der Kohlenwertstoff-Verbaende: Benzin-Benzolverband	Voesendorf	S-L-A	1,100		
A. G. der Shell Florisdorfer Mineraloelfabrik, c/o Shell Austria, A. G., Weiserstasse 2, Salsburg	Florisdorf	S-L-A	3,400		
Creditul Minier, A. G.	Korneuburg	S	2,400		
Donau Oeltanklager G.m.b.H	Mossbierbaum	S	4,000		
"Nova" Oel und Brennstoff-Gesellschaft, A. G.	Schwachat	S-L	3,200		
Oesterreichische Mineraloelwerke G.m.b.H.	Lobau	Comp.	4,900	7.80	
Vacuum Oil Co., A. G.	Kagran	S-L-A	2,100		
Total Soviet Zone[1]			21,100	7.80	
Total Austria			23,300	7.80	

(1) Estimate from reliable source.

Bahrein Island

Operations of Bahrein's only refinery involve a variety of processes. The refinery is equipped with catalytic thermal cracking, polymerization, and alkylation facilities. It is also set up to product asphalts at the rate of 75,000 long tons per year.

Modernization of the plant's catalytic cracking installation is currently under way. This project will increase capacity of the unit from 21,300 to 26,000 bbl. per day and is aimed toward improving its operation. Completion is scheduled for early 1953.

BAHREIN ISLAND

Bahrein Petroleum Co., Ltd., 551 Fifth Ave., New York 17, U.S.A.	Bahrein	S-C-A	155,000	[1]35,200	[2]21,300

(1) Includes 19,000 bbl. per day of reforming capacity. (2) Capacity of cat cracker scheduled to be increased to 26,000 bbl. per day.

Belgium

During 1952 Belgian refining capacity was stepped up by more than 50 per cent. In 1953, capacity will be boosted again. This latter increase will bring Belgium's total to nearly 114,000 bbl. daily. By 1954, Belgium's total refining capacity will be nearing the 150,000-bbl. per day mark.

Currently there are four catalytic cracking projects under way in Belgian plants. Three of these projects are scheduled for completion in 1954. The other cat unit is scheduled to go on stream a year later. Capacity of all of these new units is around 25,000 bbl. daily.

BELGIUM

"Albatros" S. A., Belge Pour le Raffinage de Petrole, 10 Petroleumkaai, Antwerp-Kiel	Antwerp-Kiel	S	[1]3,500		(1)
Belgian Shell Co., S. A., 47 Cantersteen, Brussels	Ghent	(2)			
Cie. Industrielle Atlas, S. A., 101 Ave. de France, Antwerp	Atlas	S	35,000	[3]17,000	(4)
Esso Standard Refinery, S. A., 101 Ave. de France, Antwerp	Antwerp[5]	S	25,000	4,000	8,000
Raffinerie Belge de Petroles, S. A., 115 Ave. de France, Antwerp	Antwerp	S-C	12,500	[6]4,200	
Raffinerie et Distilleries Anversoises, Antwerp	Antwerp	S	1,700		
Ste. Industrielle Belge des Petroles, Boite Postale No. 55, Krilisschans, Antwerp	Antwerp	S-C	35,000	[6]17,000	(4)
Tankage et Transport, S. A., 10 Palace Leopold, Antwerp	Antwerp-Kiel	S	1,200		
Total Belgium			113,900	42,200	8,000

(1) Capacity to be increased to 11,000 bbl. per day. Expansion includes 3,650 bbl. per day catalytic cracker. (2) Refinery processes reduced crude oil to lubes and asphalts. (3) Includes visbreaking and reforming capacities. (4) Catalytic cracking rated at 9,000 bbl. per day to be installed in 1954. (5) Under construction. Scheduled for completion by mid 1953. (6) Includes 1,200 bbl. per day reforming and 1,000 bbl. per day visbreaking capacities.

BOLIVIA

Yacimientos Petroliferos Fiscales Bolivianos Ave. Gral. Camacho, La Paz	Camiri	S	1,500		
	Cochabamba	S	5,000		
	Sanandita	S	410		
	Sucre	S	4,000		
Total Bolivia			10,910		

Brazil

Current activity in expansion of Brazil's refining industry includes three major projects. Conselho Nacional do Petroleo has a 45,000-bbl. per day refinery under construction at Cubatao. Second of the major projects is a new 20,000-bbl. per day refinery under construction for Rafineria e Exploracao de Petroleo at Capuava. The other

Brazil (continued)

project is a 10,000-bbl. per day plant near Rio de Janeiro. This refinery is being installed for Rafineria de Petroleos de Manguinhos, S. A.

Brazil's National Petroleum Council has under study a 2,000-bbl. per day refinery which would be located at Manaus on the Amazon River. The council has had under study for some time another refinery which would be located near the mouth of the Amazon, at Belem.

Catalytic cracking facilities will be installed only at the new 25,000-bbl. per day refinery of Rafineria e Exploracao de Petroleo, according to current reports from Brazil.

BRAZIL

Company and address—	Refinery location	Type of plant	Charging capacity, bbl. per day: Crude oil	Thermal operations	Catalytic operations
Conselho Nacional do Petroleo, Av. Presidente Wilson 164, Rio de Janeiro	Cubatao	S-C	(1)	.....	.....
	Mataripe	S	5,000	2,500	.....
Distilaria Rio Grandense de Petroleo, S. A., Uruguaiana	Uruguaiana	S	300	.....	.....
Industrias Matarazzo de Energia, S. A., Predio, Count Matarazzo Building, Praca do Patriarcha S/N, Sao Paulo	Sao Paulo	S-W-A	1,000	.....	.....
"Ipiranga," S. A., Cia. Brasileira de Petroleos, Saco Da Mangueira	Rio Grande	S-A	6,000	[2]2,000	.....
Refinaria de Petroleos de Manguinhos, S. A., Ave. Marechal Floriano No. 6, Rio de Janeiro	Rio de Janeiro	(3)	.....	.....	.....
Rafineria e Exploracao de Petroleo, Capuava, Sao Paulo	Capuava	(4)	.....	.....	.....
Total Brazil			12,300	4,500	.....

(1) New 45,000-bbl. per day refinery under construction. (2) Idle capacity. (3) New 10,000-bbl. per day refinery scheduled for 1954 completion. (4) New 20,000-bbl. per day refinery scheduled for 1954 completion.

BULGARIA

First Bulgarian Petroleum Refinery Co.	Russe	S	900	.....	.....
"Petrole" Co., S. A. B.	Russe	S	750	.....	.....
Svetlina, S. A. B.	Russe	S	600	.....	.....
Total Bulgaria			2,250	.....	.....

(1) Estimate from reliable source.

Burma

Burmah Oil Co. (Burma Concessions), Ltd., operates the only refinery in Burma. This refinery is being enlarged from 2,000 bbl. per day to 3,000 bbl. per day. The additional capacity is scheduled to go on stream in 1953. With the additional capacity the refinery is expected to supply the country's internal requirements for petroleum products.

BURMA

Burmah Oil Co., (Burma Concessions), Ltd., P.O. Box 1049, Merchant St., Rangoon	Chauk	S	3,000	.....	.....

Canada

Although Canada's refining capacity has been boosted appreciably during the last few years, the various projects still under way and scheduled raise the nation's total capacity to nearly ½ million barrels per day. These projects are expected to be completed within the coming year. The new 5,000-bbl. topping plant being built by Refinery Operators, Ltd., at Coleville, Sask., is also included in this group.

Canada's catalytic cracking capacity now stands at approximately 113,000 bbl. daily. New capacity to be added before the end of 1954 will raise this figure to around 135,000 bbl. per day.

Most of the expansion in Canada is currently in the Province of British Columbia. This was brought about by a new pipe line being built to serve the area. The line originates in Alberta.

CANADA

Anglo-Canadian Oils, Ltd, P.O. Box 99, Brandon, Man.	Brandon, Man.	S-C	3,000	1,400	.....
British American Oil Co., Ltd., British American Oil Co. Building, Toronto, Ont.	Calgary, Alta.	S-C-A	7,200	2,500	.....
	Clarkston, Ont.	Comp.	17,000	4,500	.....
	Edmonton, Alta.	S-C	5,750	1,400	[13]3,000
	Montreal East, Que.	S-C-A	40,000	7,500	[11]6,900
	Moose Jaw, Sask.	S-C-A	15,000	6,000	[14]4,400
Canadian Oil Refineries, Ltd., Corunna, Ont.	Corunna	S-C	20,000	2,900	[21]4,000
Excelsior Refineries, Ltd., 227 Tegler Building, Edmonton, Alta.	Lloydminster, Alta.	S-A	2,500	.....	.....
Gas & Oil Refineries, Ltd., 301 Lancaster Building, Calgary, Alta.	Hartell, Alta.	S-C	2,500	[2]2,300	.....
Hi-Way Refineries, Ltd., 714 Broder Building, Regina, Sask.	Rosetown, Sask.	S	350	.....	.....
	Saskatoon, Sask.	S-C-A	2,800	800	.....
Husky Oil & Refining, Ltd., Lloydminster, Sask.	Lloydminster, Alta.	S-A	[4]12,500	.....	.....
Imperial Oil, Ltd., 56 Church St., Toronto, Ont.	Calgary, Alta.	S-C	[5]9,200	4,600	.....
	Edmonton, Alta.	S-C	[6]22,600	9,100	[10]10,000
	Halifax, N. S.	S-C	[7]22,000	[8]10,000	.....
	Ioco, B. C.	S-C	22,500	7,600	.....
	Montreal East, Que.	S-C	46,000	[9]14,300	[14]4,500
	Norman Wells, N.W.T.	S	[12]1,250	.....	.....
	Regina, Sask.	S-C	[11]20,000	9,700	[17]7,500
	Sarnia, Ont.	S-C	72,500	[12]27,000	[23]3,250
	Winnipeg, Man.	S-C	[13]12,000	.....	[13]3,600
McColl-Frontenac Oil Co., Ltd., Royal Bank Building, Montreal, Que.	Edmonton, Alta.	S-C	5,500	2,250	[12]2,600
	Montreal East, Que.	S-C	19,100	15,500	.....

CANADA (Continued)

Company and address—	Refinery location	Type of plant	Charging capacity, bbl. per day: Crude oil	Thermal operations	Catalytic operations
Moose Jaw Refineries, Ltd., Moose Jaw, Sask.	Moose Jaw, Sask.	S	1,500		
New Brunswick Oil Fields, Ltd., P.O. Box 194, Moncton, N. B.	Weldon, N. B.	S	300		
North Star Oil, Ltd., 303 Scott Block, Winnipeg, Man.	St. Boniface, Man.	S-C	4,200	1,800	
Northern Petroleum Corp., Ltd., Kamsack, Sask.	Kamsack, Sask.	S	600		
Prince Albert Refineries, Ltd., Moose Jaw, Sask.	Prince Albert, Sask.	S	500		
Radio Oil Refineries, Ltd., Munroe and Watt Sts., East Kildonan, Man.	East Kildonan, Man.	S	1,000		
Saskatchewan Federated Cooperatives, Ltd., 211 Ave. D, Saskatoon, Sask.	Regina, Sask.	S-C	5,500	2,400	
Shell Oil Co. of Canada, Ltd., 25 Adelaide St., East Toronto, Ont.	Burnaby, B. C.	S-C-A	7,000	2,400	
	Montreal East, Que.	S-C	33,000	9,900	[1]12,500
Standard Oil Co. of British Columbia, Ltd., 906 Marine Building, Vancouver, B. C.	Burnaby, B. C.	S-A	8,350		
Supreme Refineries, Ltd., 523 Twenty-fourth Ave., West, Calgary, Alta.	Ogden, Alta.	S	1,000		
Trinidad Leaseholds (Canada), Ltd., Port Credit, Ont.	Port Credit	S-C	6,000	3,500	
Wainwright Refineries, Ltd., Wainwright, Alta.	Wainwright	S	300		
Total Canada			450,500	149,300	112,250

(1) Cracking. (2) Includes 10,000 bbl. per day cracking capacity and 4,000 bbl. per day Platforming capacity. (3) Includes 800 bbl. per day idle reforming capacity. (4) Total capacity of two refineries at Lloydminster. (5) Includes 1,450 bbl. per day idle capacity. (6) Includes 2,610 bbl. per day idle capacity. (7) Includes 1,520 bbl. per day idle capacity. (8) Combination thermal cracking operation. (9) Visbreaking capacity 10,500 bbl. per day and reforming capacity 3,800 bbl. per day. (10) Includes 376 bbl. per day idle capacity. (11) Includes 3,090 bbl. per day idle capacity. (12) Includes 4,000 bbl. per day visbreaking capacity. (13) Includes 830 bbl. per day idle capacity.

Canary Islands (Spain)

During 1953, the refinery operated by Cia. Espanola de Petroleos, S. A., at Santa Cruz de Tenerife will be increased from 17,000 to 27,000 bbl. per day. In addition the plant will be equipped with a Platforming unit.

CANARY ISLANDS (SPAIN)

Cia. Espanola de Petroleos, S. A., Alcala 31, Madrid	Sta. Cruz de Tenerife	Comp.	[1]27,000	3,700	[2]

(1) Distillation unit rated at 10,000 bbl. per day under construction and to be completed in 1953. (2) Platforming unit under construction.

Chile

Except for a small field skimming plant which supplies gasoline and other light products for local consumption, Chile has no refining capacity at this time. However, this situation is to be altered before 1955.

Currently, the Chilean Government through its operating company, Empresa Nacional del Petroleo, has under construction at Valparaiso, a 20,000-bbl. per day refinery. This new plant is being set up with three different types of thermal processes having a total capacity rating in excess of 15,000 bbl. daily. Largest of these processes is thermal cracking (6,200 bbl. daily); next visbreaking 4,960 bbl. per day; and reforming 3,960 bbl. per day.

CHILE

Empresa Nacional del Petroleo, Ramon Nieto 920, Santiago	Valparaiso	S-C	[1]	[1]	

(1) New 20,000-bbl. per day refinery under construction. Completion scheduled for 1954. Facilities also include thermal cracking (6,200 bbl. per day), thermal reforming (3,970 bbl. per day) and visbreaking (4,960 bbl. per day).

CHINA

Reliable information on refining operations is not currently available from this Communist country. Latest dependable reports indicate a 2,000-bbl. topping-cracking plant is operating in Kansu province near the producing area of Yumen.

Colombia

Colombia's present refining picture consists of two topping plants, one of which is set up to produce lubricating oils. The smaller of these plants is scheduled for an increase of nearly 4,000 bbl. per day. Principal among the facilities included in the expansion program is a 2,200-bbl. per day crude-oil-distillation unit.

Empresa Colombiana de Petroleos, the Colombian Government's operating company for its Barranca-Bermeja refinery, has under way a substantial expansion and modernization program. Crude-oil-distillation facilities at the refinery are being upped to 35,000 bbl. per day. It is operated under contract by International Oil Co. of Colombia.

Other facilities being installed at Barranca-Bermeja include 16,500 bbl. per day of visbreaking capacity and 15,000 bbl. per day of catalytic cracking. The project at Empresa's plant is expected to be completed in 1954.

COLOMBIA

Colombian Petroleum Co., Cucuta	Petrolea	S	[1]840		
Empresa Colombiana de Petroleos,[2] Banco de Colombia, Bogota	Barranca-Bermeja	S-L	[2]28,000	[3]	[3]
Total Colombia			28,840		

(1) Crude-oil distillation unit (2,200 bbl. per day) to be added. (2) Operated under contract by International Oil Co. of Colombia. (3) Refinery being expanded to 35,000 bbl. per day crude-oil capacity, 16,500 bbl. per day visbreaking capacity and 15,000 bbl. per day catalytic cracking capacity.

CUBA

Esso Standard Oil Co. (Cuba), Apartado 1303, Havana	Belot	Comp.	5,500	1,400	
Petrolea Jarahueca, S. A., Jarahueca	Jarahueca	S	200		
Total Cuba			5,700	1,400	

(1) Field operations include four small topping plants. These plants are operated on an intermittent basis and total approximately 2,000 bbl. per day capacity.

CZECHOSLOVAKIA

Company and address—Former operator[1]	Refinery location	Type of plant	Charging capacity, bbl. per day: Crude oil	Thermal operations	Catalytic operations
"Apollo" Raffineria Mineralnych Olejov, Uc., Spol.	Bratislava	S-C-L	[2]2,200	1,100	
Franto-Werke, A. G.	Bohumin	S-L	1,500		
	Pardubice	S-L-C	4,000	1,600	
Kralupska Raffineria Mineralnych Olejov, Uc., Spol., Prague	Kralupy n'Vlt	S	1,000		
Priemselna A. Obchodna, Uc., Spol.	Dubova	S-L-A	1,800		
Privozer Mineraloelwerke, A. G., Morauska, Ostrava	Privoz	S	1,300		
Vacuum Oil Co.	Kolin	S	1,800		
Total Czechoslovakia[3]			13,600	2,700	

(1) Now operated by government due to nationalization. (2) "Apollo" plant at Weikersdorf, rated at 400 bbl. per day, was merged with refinery at Bratislava. (3) Estimate from reliable source.

DENMARK

Dansk Mineralolliefabrik, Copenhagen	Copenhagen	S	50		
A/S Kalundborg Olieraffinaderi, 13 Sankt Annae Plads, Copenhagen	Klundborg	S	800		
L. C. Glad Co., A. S., Copenhagen	Copenhagen	S	70		
Total Denmark			920		

Ecuador

A 2,000-bbl. per day crude-oil stripping plant is scheduled to be built in Ecuador. This project is to be carried out in connection with Manabi Exploration Co., Inc.'s other activities in Ecuador's Tigre field.

ECUADOR

Anglo-Ecuadorian Oilfields, Ltd., Casilla 410, Guayaquil	La Libertad	S	5,000		
Manabi Exploration Co., Inc., Apartado 4075, Guayaquil	Cautivo	S	700		
Total Ecuador[1]			5,700		

(1) Estimated.

Egypt

Plans are currently under way to more than triple capacity of the Egyptian Government's refinery at Suez. This plant, now rated at 9,000 bbl. per day, is scheduled to be increased to 28,000 bbl. per day in the near future. Latest reports from Egypt do not reveal the date on which the project is expected to be completed.

EGYPT

Anglo-Egyptian Oilfields, Ltd., Shell House, 6 Sharia Tewfic, Cairo	Suez	S-C	41,000	6,400	
Raffinerie de Petrole du Government, 18 Rue Fouad Ier, Alexandria	Suez	S	[1]9,000		
Total Egypt			50,000	6,400	

(1) Refinery scheduled to be increased to 28,000 bbl. per day.

FORMOSA

Chinese Petroleum Corp.	Kaoshiung Tiawan	S-C-A	[1]15,000	[1]2,000	

(1) Estimated.

France

Within the past few years refining capacity in France has been substantially increased. In addition to this expansion, modernization has been carried out generally in French plants. Even today, programs for modernization and expansion are still in effect.

Currently there are four catalytic units being installed in French refineries. Most of these new units are scheduled to go into service in 1953. By 1955 another 11,000 to 15,000 bbl. per day of catalytic processing will be added to bring the nation's total to or near the 50,000-bbl. per day mark.

FRANCE

Cie. Francaise de Raffinage, 11 Rue Doctor Lanceraux, Paris 8	Gonfreville	Comp.	65,000	12,600	(7)
	La Mede	S-C-W	50,000	14,000	
Cie. de Raffinage Shell-Berre, 29 Rue de Berre, Paris 8	Berre L'Etang	Comp.	68,200	[2]11,300	[3]4,200
	Petit-Couronne	Comp.	35,000	[2]2,800	
	Pauillac	S-A	12,000		
Esso Standard, S. A., Francaise, 82 Av. des Champs Elysees, Paris 8	Port Jerome	Comp.	44,800	6,150	[5]10,000
Pechelbronn, S. A., d'Explorations Minieries, 4 Rue Leon Jost, Paris 17	Merkwiller	S	1,600		
Raffineries Francaises des Petroles de L'Atlantique, Donges-St. Nazaire	Donges	S-C-L	33,000	3,800	[5]10,000
Ste. des Raffineries de Petrole de la Gironde, 7 Palace Vendome, Paris	Ambes	S-C	16,500	2,500	
Ste. General des Huiles de Petrole, B.P., 21 Rue de la Bienfaisance, Paris 8	La Vera	S-C	40,000	4,400	
	Dunkirk	Comp.	40,000	5,000	(6)
Socony-Vacuum Francaise, 46 Rue de Courcelles, Paris 8	N. D. de Gravenchon	Comp.	17,300	[3]3,140	
	Frontignan	S-C	25,500	[3]3,380	11,150
Total France			456,400	70,490	35,350

(1) Catalytic cracker rated at 11,000 bbl. per day under construction. (2) Includes 2,800 bbl. per day of idle capacity. (3) Catalytic cracker rated at 8,000 bbl. per day under construction. (4) Thermal cracking unit used either for crude-oil distillation or for reforming operations. (5) Catalytic cracker rated at 10,000 bbl. per day and associated facilities under construction. Completion scheduled for 1953. Construction is also under way on a 25,000-bbl. per day two-stage distillation unit. (6) Platforming unit to be installed in 1954. (7) Reforming capacity.

French Morocco

The only refinery in French Morocco is to be equipped with a catalytic cracking unit during 1954. No increase in the refinery's crude-oil capacity is expected. The plant is currently rated at slightly more than 2,000 bbl. daily.

FRENCH MOROCCO

Company and address—	Refinery location	Type of plant	Charging capacity, bbl. per day: Crude oil	Thermal operations	Catalytic operations
Ste. Cherifienne des Petroles, 27 Av. Urbain Blanc, Rabat	Petitjean	S	2,100	.....	(1)

(1) Catalytic cracker to be built by 1954.

Germany

Western Germany's refining capacity is made up of 22 operable plants. Combined crude-oil input rating on these plants is nearly 141,000 bbl. daily. One of the plants, Ebano Asphalt Werke, near Hamburg, is to have its capacity doubled in 1954. Currently the refinery is rated at 15,000 bbl. daily.

Another plant, Scholven-Chemie, A. G., at Gilsenkirchen, is scheduled for an increase at a later period. Plans call for the Scholven-Chemie plant to be equipped with catalytic cracking.

A third major project in Germany involves a new 10,000-bbl. per day refinery in the Emsland district.

GERMANY

Badische Anilin und Soda-Fabrik, Ludwigshaven-Oppau	Ludwigshaven	S-L-W	1,000	.....	.....
B. P. Benzin und Petroleum Gesellschaft, 5 Steinstrasse, Hamburg 1	Hamburg	S-C	13,000	[1]7,000	(2)
Deutsche Erdoel, A. G., Spitalerstrasse 10, Hamburg 1	Heide	Comp.	3,000	.....	6,300
	Wietze	S-L-A	1,400	.....	.....
Deutsche Gasolin, A. G., 32 Jordanstrasse, Hannover	Dollbergen	S-L-A	2,500	.....	.....
Deutsche Shell, A. G., Shell Haus, Alsterufer 4-5 (24a) Hamburg 36	Harburg	S-A	10,600	.....	.....
Deutsche Vacuum Oel, A. G., Bartholomay Haus, Steinstrasse 5-7 (24a), Hamburg 1	Monheim	S-A	4,600	.....	.....
	Bremen	S-L-W	12,700	.....	8,400
Ebano Asphalt Werke, A. G., Neuer Jungfernsteig 21, Hamburg	Hamburg	S-A	[3]15,000	.....	.....
Gelsenberg Benzin, A. G., Gelsenkirchen	Gelsenkirchen	S-C	17,000	.....	[4]7,600
Gewerkschaft Deurag-Nerag Hindenbergstrasse 27-29, Hannover	Misburg	Comp.	12,000	3,800	.....
Georg Greiser Bergbau und Chemische Fabriken Mineraloelwerke, Herman Pfeifer G.m.b.H., Dollbergen Uber Lehrte	Dollbergen	S	500	.....	.....
Kraftstoff-Handelsgesellschaft, m.b.H., Rathenaustrasse 8, Essen	Essen	S	750	.....	.....
Mineraloelwerke Albert Sengewald, Dedenhausen Uber Lehrte	Dedenhausen	S	900	.....	.....
Mineraloelwerke Peine, Zweigniderlassung der Oelwerke Julius Schindler G.m.b.H., Peine bie Hannover	Peine	S-L	450	.....	.....
Oelwerke Julius Schindler, G.m.b.H., Hohe Bleichen 28, Hamburg 36	Neuhot	S-L	4,000	.....	.....
Ruhrbau, G.m.b.H., Timmerhellstrasse, Muelheim/Ruhr	Muelheim	S	6,300	.....	.....
Rusrchemie, A. G., Oberhausen-Holten	Oberhausen	S-C	6,000	.....	[5]2,500
Ruhroel, G.m.b.H., Postfach 122, Bottrop	Bottrop	S	5,200	.....	.....
Scholven-Chemie, A. G., Dorstner Str. 227, Gilsenkirchen-Buer	Gilsenkirchen	S-C	5,200	.....	[6]2,000
Union Rehinische Braunkihlen Kraftstoff, A. G., Wesseling bie Koeln	Wesseling	S-C	17,000	.....	[7]6,300
Wintershall, A. G., Friedrich Ebert Strasse 160, Kassel	Salzbergen	S-C	2,000	500	.....
Zeller & Gmelin, Postschliessfach 35, Eislingen-Fils	Eislingen	S	[8]	.....	.....
Total Germany			140,500	11,300	33,100

(1) Combination thermal cracking and crude-oil distillation unit. (2) Platformer to be installed in 1954. (3) Capacity to be increased to 30,000 bbl. per day in 1954. (4) Hydrogenation operation. (5) Catalytic reforming unit. (6) Hydrogenation unit. Expansion plans call for capacity increase of refinery and installation of catalytic cracker. (7) Hydrogenation capacity. (8) Refinery currently not operating. Capacity rating on plant is 170 bbl. of crude oil daily.

HAWAIIAN ISLANDS

Pacific Refiners, Ltd., Honolulu	Honolulu	(1)	.....	.....	.....

(1) Refinery operates on heavy crude oil mixed with butane which mixture is imported.

HUNGARY

Former owner—					
Fanto Egyesult Asvanyolajgyarak, R. T.	Budapest-Gyoervar[1]	S	[1]1,100	.....	.....
Hazai Koeolaj Ipar, R. T.	Budapest	S	[1]1,000	.....	.....
Magyar Petroleum Ipar, R. T.	Budapest-Csepel	S	[2]750	.....	.....
"Molaj" Magyar-Szovjet Olaj Muvek, R. T.	Szoeny	S	[3]7,600	.....	.....
Nyierbogdany Petroleumgyar, R. T.	Budapest-Csepel	S-L	[4]1,370	.....	.....
Peti Nitrogen Muevek, R. T.	Petfuerdo	S-C	4,950	(5)	.....
Shell Hoeolaj, R. T.	Budapest-Csepel	S-C-L	5,000	(5)	.....
Szoeregy Petroleumgyar, R. T.	Szoereg	S	450	.....	.....
Total Hungary[6]			22,220	.....	.....

(1) Obsolete and inefficient operations, equipment expected to be dismantled. (2) War damaged plant restored to operation early in 1947. (3) Partly war damaged and some equipment dismantled by Russians. Plant restored to normal capacity since 1946. (4) Minor war damage repaired in 1946. (5) Cracking unit of unknown capacity has been recently installed. (6) Estimate from reliable source.

India

Refining capacity in India is currently limited to one small plant. However, by 1956 new-refinery capacity will increase India's total to more than 65,000 bbl. daily. This additional capacity, 60,000 bbl. per day, is made up by two plants in the Bombay area.

Burmah-Shell Refineries, Ltd., is the owner of one of the Bombay plants. This installation, rated at 40,000 bbl. daily, is scheduled for completion in 1956.

Standard-Vacuum Oil Co., schedules completion of its 20,000-bbl. per day plant for 1954.

INDIA

Company and address—	Refinery location	Type of plant	Charging capacity, bbl. per day: Crude oil	Thermal operations	Catalytic operations
Assam Oil Co., Ltd., Digboi P.O., Upper Assam	Digboi	Comp.	5,750	1,500	.....
Burmah-Shell Refineries, Ltd., Bombay	Bombay	(1)	.....	.....	.....
Standard-Vacuum Oil Co.	Bombay	(2)	.....	.....	.....
Total India			5,750	1,500	.....

(1) New 40,000-bbl. per day refinery scheduled for completion in 1956. (2) New 20,000-bbl. per day refinery under construction. Completion scheduled for 1954.

Indonesia

After 6 years of rehabilitation work, N.V. de Bataafsche Petroleum, Mij., now has its Balikpapan refinery set up on a 46,000-bbl. per day charge basis. Recently a third distillation unit was placed on stream at the plant. This new unit raised the refinery's crude-oil capacity rating by approximately 20,000 bbl. daily.

INDONESIA

N.V. de Bataafsche Petroleum, Mij., Carl Van Byjiantlaan 30, The Hague, Netherlands	Balikpapan, Borneo	S-W	46,000	.....	.....
	Tjepu, Java	S	3,600	.....	.....
	Worokromo, Java	S-A	2,000	.....	.....
	Pangkalanbrandan, Sumatra	(1)	.....	.....	.....
	Pladju, Sumatra	S-C	83,000	[2]25,000	.....
Sarawak Oilfields, Ltd., Miri, Sarawak	Lutong, Sarawak	S	43,500	.....	.....
Standard-Vacuum, Mij., Carl Van Byjiantlaan 30, The Hague, Netherlands	Sungei-Gerong, Sumatra	S-C-W	64,000	31,000	.....
Total Indonesia			242,100	56,000	.....

(1) Refinery is currently inaccessible. (2) Includes 15,000 bbl. per day of reforming capacity of which 7,500 bbl. per day are inoperative.

IRAN[1]

Anglo-Iranian Oil Co., Ltd., Britannic House, Finsbury Circus, London E. C. 2, England	Abadan[2]	Comp.	500,000	75,000	25,000
Kermanshah Petroleum Co., Ltd., Britannic House, Finsbury Circus, London, E. C. 2, England	Kermanshah[3]	S	2,500	.....	.....
Total Iran[4]			502,500	75,000	25,000

(1) In March 1952, oil industry in Iran was nationalized. (2) Refinery not now being operated by Anglo-Iranian Oil Co., Ltd. (3) Refinery not now being operated by Kermanshah Petroleum Co., Ltd. (4) Both refineries are believed to be operating on reduced and part-time basis.

IRAQ

Iraq Petroleum Co., Ltd., 214 Oxford St., Oxford Circus, London W. 1, England	Baba Gurgur	S	1,500	.....	.....
Iraq Government	Alwand[1]	S	8,000	.....	.....
Total Iraq			9,500	.....	.....

(1) Formerly operated by Khanquin Oil Co., Ltd.

ISRAEL

Consolidated Refineries, Ltd., Britannic House, Finsbury Circus, London E. C. 2, England	Haifa	S-C	[1]85,500	[2]36,400	.....

(1) Includes 57,000 bbl. per day of idle capacity comprised of two units. (2) Includes 17,000 bbl. per day of idle reforming capacity and 19,400 bbl. per day of visbreaking capacity.

Italy

Two new refineries and expansion of a third plant contribute to the major increases in Italy's refining capacity for 1953. Condor's installation at Rho, a new plant, is the largest of these major projects. This new refinery has a crude-oil capacity rating of 45,000 bbl. per day. Facilities also include a 15,000-bbl. per day catalytic cracking unit.

The other new refinery is being installed for Societa per Azioni Raffineria Panda Olii Mineral at San Martino di Trecate.

Raffinerie Sicilane Oli Minerali, S. A., is doubling the capacity of its Augusta, Sicily, refinery to a crude-oil capacity of 20,000 bbl. daily.

ITALY

"Aquila" Societa Tecnico-Industriale, via Dante 5, Trieste	Aquilina, Trieste	S-C	15,000	3,300	.....
"Condor," S.p.A. per L'Industria Petrolifera e Chemica, Milan	Rho	S-C	[1]45,000	.....	[1]15,000
Esso Standard Italiana, S.p.A., via Assarotti 40, Genoa	San Sabba, Trieste	S	2,400	.....	.....
Industrie Chimiche Italian del Petroleo, Mantova	Mantova	S-C	6,000	.....	[2]2,500
Industria Raffinazione Oli Minerali, S.p.A., via Barberini 67, Rome	Venice	S-C-L-A	30,000	[3]7,000	.....
Lombardi Petroli, Villasanta, Lombardia	Villasanta	S	2,400	.....	.....
Permolio Raffinerie Italiane Oli Minerali, Milan	Genoa	S-C-A	2,500	.....	1,050
	Milan	S-A	3,200	.....	.....
	Rome	S-C-A	2,000	.....	1,050
Petroli D'Italia, Fiorenzuolla d'Ardia, Emilia	Emilia	S	2,200	.....	.....
Raffinerie Sicilane Oli Minerali, S. A., Augusta, Sicily	Augusta, Sicily	S	[4]10,000	.....	.....
Societa per Azioni Raffineria Padena Olii Mineral, Piazza San Sarlo 161, Turin	San Martino di Trecate	S-C[5]	13,300	3,150	.....
Societa per l'Industria Italiana del Petrolio, Casella Postale 810, Genoa	La Spezia	Comp.	30,000	8,450	.....
Societa Petrolifera Italiana, Farnovo Taro (Parma)	Fornovo Taro	S	1,500	.....	.....
Socony-Vacuum Italiana S.p.A. 26, Broadway, New York 4, N. Y., U. S. A.	Naples	Comp.	60,000	[6]5,000	.....
Staniac-Industria Petrolifera S.p.A., Corso d'Italia 39A, Rome	Beri	S-C	26,000	3,500	.....
	Livorno	S-C	16,000	1,500	.....
Total Italy			257,500	31,900	19,600

(1) New refinery to be placed in operation early in 1953. (2) Catalytic reforming operation. (3) Includes 6,200 bbl. per day of thermal reforming capacity. (4) Expansion to 20,000 bbl. per day planned. (5) New refinery. (6) Reforming capacity.

Japan

Refining capacity in Japan is scheduled to be boosted to near the 100,000-bbl. per day mark before 1955. Currently, Maruzen Oil Co., Ltd., has under consideration plans for increasing its Kaiso-Gun plant to 15,500 bbl. daily. This increase amounts to 4,000 bbl. per day above the plant's current crude-oil-input rating.

Other crude-oil-capacity increases include Nippon Petroleum Refining Co., Ltd., Kudamatsu plant, and the former Japanese Navy installation at Yokkichi. This latter plant is identified with Daikyo Oil Co., Ltd. Nippon Petroleum Refining Co.'s refinery is being considered for a capacity increase of 5,000 bbl. daily. A new Platforming unit is also included in plans for the Kudamatsu plant.

The former Japanese Navy installation, severely damaged during the war, is being sought by several organizations. When rebuilt, this refinery is expected to have a crude-oil capacity of 8,000 bbl. daily.

Kao Oil Co., Ltd., has recently added 3,500 bbl. per day of crude-oil capacity to its Iwakuni plant. Other new units going into service during 1952 include a 3,000-bbl. per day catalytic cracker at Maruzen Oil Co.'s Kaiso-Gun refinery.

Platforming units are scheduled to be installed in the Iwakuni refinery operated by Kao Oil Co., Ltd., and in the Kudamatsu installation of Nippon Petroleum Refining Co., Ltd. These units are expected to go into service before 1955.

JAPAN

Company and address	Refinery location	Type of plant	Charging capacity, bbl. per day: Crude oil	Thermal operations	Catalytic operations
Daikyo Oil Co., Ltd.	Yokkaichi	S	6,000		
Kao Oil Co., Ltd., Eiaku Building, No. 2 Chome, Marunouchi Chiyoda-ku, Tokyo	Iwakuni	Comp.	[1]10,000	1,400	(2)
Maruzen Oil Co., Ltd., No. 6, 3-Chome, Hongoku-Cho, Nihonbashi, Cho-ku, Tokyo	Kaiso-Gun	S-L-A	[3]11,500		[4]3,000
	Matsuyama	S	4,000		
Mitsubishi Oil Co., Ltd., No. 1 Shiba-Kotohira-Cho, Minato-ku, Tokyo	Kawasaki City	Comp.	13,200	3,000	
Nippon Mining Co.	Funakawa	S	5,000		
Nippon Petroleum Refining Co., Ltd., Tokyo	Kudamatsu	S-L-A-W	7,000		(5)
	Yokohama	Comp.	7,000		[6]5,600
Showa Oil Co.	Kawasaki	S	9,000		
	Niigata	S	1,000		
	Hirasawa	S	800		
Standard-Vacuum Oil Co., 26 Broadway, New York 4, N. Y., U. S. A.	Ihara-Gun	S-L-A	5,000		
	Kaiso-Gun	Comp.	10,000	3,500	
Total Japan			89,500	7,900	8,600

(1) Includes 3,500 bbl. per day of new capacity. (2) New 1,300-bbl. per day Platformer to be completed in 1954. (3) Plans are under way to increase capacity to 13,500 bbl. per day. (4) New catalytic cracking unit. (5) Platformer to be installed by 1954. (6) Partly estimated.

Kuwait

Kuwait's only refinery, located at Mina al Ahmadi, was recently increased from 25,000 to 30,000 bbl. daily. Refining capacity in Kuwait is believed still inadequate. Operator of the plant at Mina al Ahmadi is Kuwait Oil.

KUWAIT

Kuwait Oil Co., Ltd., No. 1 Great Cumberland Place, London W. 1, England	Mina al Ahmadi	S	[1]30,000		

(1) Includes 5,000 bbl. per day of new capacity.

Lebanon

Currently Lebanon has one operating refinery. This plant is rated at 100,000 bbl. per day, crude-oil input. A new 7,000-bbl. per day refinery is now under construction at Sidon. Facilities for this new refinery include a 600-bbl.-daily Platformer. Completion schedule for the new refinery is set for 1954.

LEBANON

Iraq Petroleum Co., Ltd., 214 Oxford St., London W. 1	Tripoli	S	100,000		
Mediterranean Refining Co., Beirut	Sidon	S-C	(1)		(1)
Total Lebanon			100,000		

(1) New refinery scheduled to be completed in 1954. Facilities include 7,000 bbl. per day distillation unit and 600 bbl. per day Platformer.

MEXICO

Petroleos Mexicanos, Av. Jurez 94, Mexico, D. F.	Arbol Grande	S-L-A-W	23,000	14,500	
	Atzcapotzalco	S-C	52,000		
	Ciudad Madero	Comp.	71,000	6,000	
	Mata Redonda	S-C	15,000	6,000	
	Minatitlan	S-L	24,000		
	Poza Rica	S	4,000		
	Reynosa	S	4,000		
	Salamanca	S-C	30,000	4,500	
Total Mexico			223,000	31,000	

Netherlands

Refining capacity in the Netherlands rose more than 50 per cent in 1952. All of this increase was in the Pernis plant of N.V. de Bataafsche Petroleum, Mij. The refinery, currently rated at 167,500 bbl. daily, is western Europe's largest single installation. The plant's increase was 67,500 bbl. per day. New facilities still under construction are expected to give the refinery an ultimate capacity of approximately 180,000 bbl. daily.

NETHERLANDS

Company and address—	Refinery location	Type of plant	Charging capacity, bbl. per day: Crude oil	Thermal operations	Catalytic operations
Caltex Petroleum, Mij., N.V., The Hague	Pernis	S-C	25,000	[1]12,900	
N.V. de Bataafsche Petroleum, Mij., Carel van Bylandtlaan 30, The Hague	Pernis	Comp.	[2]167,500	[3]28,500	[4]25,000
Total Netherlands			192,500	41,400	25,000

(1) Includes 6,500 bbl. per day reforming capacity. (2) Includes 67,500 bbl. per day of new capacity. (3) Includes 8,500 bbl. per day reforming capacity. (4) Catalytic cracking operation.

NETHERLANDS WEST INDIES

Lago Oil & Transport Co., Ltd., Aruba, N. W. I.	Aruba	S-C	440,000	[1]275,000	37,000
N.V. Arend Petroleum Mij., Orangestad, Aruba, N. W. I.	Aruba	S	30,000		
N.V. Curacaosche Petroleum Industrie, Mij., Carel van Bylandtlaan 30, The Hague, Netherlands	Curacao	Comp.	200,000	[2]118,000	
Total Netherlands West Indies			670,000	393,000	37,000

(1) Includes 50,000 bbl. per day of thermal cracking capacity and 16,000 bbl. per day of reforming capacity operating in visbreaking service. (2) Includes 18,000 bbl. per day of reforming capacity.

NORWAY

A/S Olandske Petroleums Compagni, Prinsgate 5, Oslo	Valloy per Tonsberg	S-L-A	1,000		

Pakistan

A technical commission, representing Burmah Oil Co., Ltd., has been studying the proposition of another refinery for West Pakistan. Recently the committee's report was presented to the Pakistan Government. Early in 1952, Burmah Oil Co., Ltd., officials offered to erect a 10,000-bbl. daily refinery at Karachi.

PAKISTAN

Attock Oil Co., Ltd., 24-28 Lombard St., London E. C. 3, England	Rawalpindi	S	4,300		

Peru

International Petroleum Co., Ltd., operator of Peru's largest refinery, has under construction a 45,000-bbl. per day distillation unit at Talara. This unit is scheduled for completion in 1954.

PERU

Cia. de Petroleo Ganzo Azul, Ltd., P.O. Box 2560, Lima	Agua	S	700		
Empressa Petrolera Fiscal, Apurimac 224, Edif Encarnacion 403, Lima	Zorritos	S	1,200		
International Petroleum Co., Ltd., 396 Alhambra Circle, Coral Gables, Fla., U. S. A.	Talara	Comp.	[1]36,440	3,000	
Total Peru			38,340	3,000	

(1) New 45,000-bbl. per day distillation unit to be placed in operation in 1954.

Philippines

The first refinery for the Philippines is scheduled to go on stream in 1954. This plant, now being erected for Caltex (Philippines), Inc., is located at Batangas, Luzon. Crude-oil capacity rating on the new installation is 13,000 bbl. daily. Facilities include a 5,400-bbl. per day catalytic cracking unit.

PHILIPPINES

Caltex (Philippines), Inc., Manila	Batangas, Luzon	S-C	(1)		(1)

(1) New 13,000-bbl. per day refinery with 5,400-bbl. per day cat cracking facilities scheduled to be placed in operation by late 1954.

POLAND

Former owner—					
Fabryka Nafty "Waleryan Stawiarski" i Ska	Krosno	S	600		
"Jaslo" Industrial Oil Works Gartenburg & Schreyer	Jaslo	S-L	1,500		
Polskie Zwiaskowe Refinerije Olejow Stalnych, S. A.	Trzebionka	S	2,500		
Societe Francaise Industrielle et Commerciale des Petroles	Jedlicze	S-L	1,500		
	Glinik Mariampolski	S-L	1,200		
Standard Nobel w Polsche, S. A.	Libusza	S-L	1,100		
Total Poland[1]			8,400		

(1) Three war-damaged plants in Polish area totaling 2,400 bbl. per day have not been returned to operational status and their restoration is believed not contemplated. A new 7,000-bbl. per day refinery is thought to be under construction at Trzebinia. Official statements indicate this new plant is expected to be placed in operation by end of 1953. Figures on Polish refining operations are competently estimated.

Portugal

Portugal's only refinery is scheduled to be shut down early in 1953 for installation of new equipment. When the refinery is returned to service its capacity rating will be 25,000 bbl. per day, 15,000 bbl. per day greater than its current rating. Included in Sacor's modernization program is a 10,000-bbl. per day cat cracker.

PORTUGAL

"Sacor" S. A., Concessionaria de Refinacao de Petroleos em Portugal, Rua do Alecrim 57, Lisbon	Lisbon	S-L-A	[1]10,000		

(1) Refinery is scheduled to be shut down in February 1953 for installation of new equipment. With new facilities refinery will have a crude-oil capacity of 25,000 bbl. per day. Expansion program includes 10,000-bbl. per day catalytic cracker and other facilities.

ROMANIA

Company and address—Former owner—	Refinery location	Type of plant	Charging capacity, bbl. per day: Crude oil	Thermal operations	Catalytic operations
Astra-Romana, S. A.[1]	Ploesti-Sud	Comp.	37,000	12,000	
Concordia, S. A. R.	Ploesti-Nord	S-L-C	22,000	4,800	
Colombia, S. A. R.	Ploesti-Sud	S-C	11,700	3,300	
Creditul Minier[3]	Brazi-Prahova	S-C	7,300	3,300	
Dacia Romano, S. A.[4]	Ploesti	S	2,900		
Doicesti, S. A. R.	Doicesti-Dambovitza	S	1,500		
Petrol Block	Ploesti-Nord	S-C	8,800	2,300	
Photogen[5]	Brasov	S-L	750		
Prahova S. A. R.[6]	Darmanesti	S-L	6,300		
Romano-Americana, S. A.[2]	Teleajen-Prahova	S-L-C	26,000	7,900	
Steaua Romana, S. A.	Campina	S-L	16,000		
Unirea (R. O. C., Ltd.)	Moinesti-Bacau	S	1,200		
	Ploesti-Sud	S-C-L	9,600	3,200	
Venus[7]	Ploesti-Sud	S-L	1,550		
Xexia, S. A.[8]	Ramnicu-Sarat	S	1,350		
Total Romania[9]			153,950	36,800	

(1) Dutch-Shell interest now known as Prima Rafinarie. (2) Standard Oil (N. J.) interest, now known as Rafinaria Teleajen. (3) Government interest. (4) Petroleum Syndicate, Ltd., interest. (5) Socony-Vacuum interest, now known as Rafinaria Muntenia. (6) Italian interest, now known as Rafinaria de Petrol Bucuresti. Original location of refinery was Bucharest. Plant was moved to present location and placed in operation in 1951. (7) Refinery is currently known as Rafinaria R. Sarat. (8) Refinery has been idle since 1948. (9) Many of the small refineries in the Moldavia area built prior to 1907 are now shut down. Additional idle plants are located in southern Romania and Translyvania. Capacity of these plants totals about 6,000 bbl. per day. Plant ratings are reliably estimated.

Saudi Arabia

Arabian American Oil Co. now has under way an expansion project at its Ras Tanura refinery which is scheduled for completion in 1953. With completion of the project the refinery will be stepped up by 50,000 per day.

SAUDI ARABIA

Arabian American Oil Co., Dhahran	Ras Tanura	S-C	210,000	[1]24,500

(1) Reforming capacity.

South Africa

By early 1954 South Africa is scheduled to have its first petroleum refinery. This installation, now being built for Standard-Vacuum Refining Co. of South Africa, Pty., Ltd., is located at Durban.

Crude-oil-input rating for the new plant is 15,600 bbl. daily. Major processing facilities also include a 9,700-bbl. per day catalytic cracking unit and a 2,000-bbl. per day reformer.

SOUTH AFRICA

South African Torbonite Mining & Refining Co., Ltd., Boksburg North, Transvaal	Boksburg	(1)		
Standard-Vacuum Refining Co. of South Africa, Pty., Ltd.	Durban	S-C	(2)	

(1) Shale-oil refinery. (2) New 15,600-bbl. per day refinery (with 9,700 cat cracking and 2,000-bbl. per day reforming) to be placed in operation by early 1954.

Spain

Spain's refining capacity was boosted 7,000 bbl. per day during 1952. This new capacity was made available to the Cartagena plant of Refinera de Petroleos de Escomberas.

SPAIN

Cia. Arrendatoria del Monoplio de Petroleos, S. A., Torija 9, Madrid	Hospitalet	S-L	700	
Refinera de Petroleos de Escomberas, S. A., Carrera de San Jeronimo 19, Madrid	Cartagena	S-C	[1]30,000	8,200
Total Spain			30,700	8,200

(1) Added capacity for 1952 is 23,000 bbl. daily.

SWEDEN

AB Nynas-Petroleum	Nysham	Comp.	11,000	[1]2,900
	Malmo	S-A	1,800	(2)
Koppartranz Oljeaktiebolag, Box 827, Skarvik, Gothenburg 8	Skarvik	S-C	22,000	4,400
Svenska, Skifferolje Aktiebolaget, Drottninggatanz, Orebro	Orebro	(3)		
Total Sweden			34,800	7,300

(1) Includes 1,900 bbl. per day reforming and 1,000 bbl. per day idle cracking capacity. (2) Reforming capacity. (3) Shale-oil refinery.

SWITZERLAND

Industrie du Petrole, S. A., Rotkreuz	Rotkreuz	S-C	4,000	[1]1,000

(1) Reforming capacity.

Trinidad

During 1953, Trinidad Leaseholds, Ltd., operator of the largest refinery in Trinidad, plans to increase capacity rating on its Pointe-a-Pierre by 15,000 bbl. daily. Plans also include a 15,000-bbl. per day catalytic cracking unit.

TRINIDAD

Company and address—	Refinery location	Type of plant	Charging capacity, bbl. per day: Crude oil	Thermal operations	Catalytic operations
Brighton Terminal, Ltd., 30 Rockefeller Plaza, New York 20, N. Y., U. S. A.	La Brea	S	5,000	.....	.....
Trinidad Leaseholds, Ltd., Trinidad House, 29-30 Old Burlington St., London W. 1, England	Pointe-a-Pierre	S-C	85,000	[1]32,000	15,000
United British Oilfields of Trinidad, Ltd., 15 Ambercrombay St., Port of Spain	Point Fortin	S-A	30,000	.....	.....
Total Trinidad			120,000	32,000	15,000

(1) Includes thermal reforming (10,000 bbl. per day) and visbreaking (10,000 bbl. per day) capacity.

TURKEY

M.T.A. Institute, Ankara	Batman	S	[1]1,400	.....	.....

(1) Current input 350 bbl. daily.

United Kingdom

Crude-oil-input capacity of United Kingdom refineries, now above 500,000 bbl. daily, is scheduled for still more increases.

During 1952, the new plant of Kent Oil Refineries, Ltd., at Kent went into service. This refinery, rated at 81,000 bbl. daily, is to be equipped with a new 10,000-bbl. per day cat cracker in 1953. The following year a 6,000-bbl. per day Platforming unit is to go into service in the refinery.

Input capacity of the Fawley installation of Esso Petroleum Co., Ltd., was increased 25,000 bbl. daily in 1952. Current rating of this plant is 140,000 bbl. per day. At the same time input capacity was increased, the refinery's catalytic cracking capacity was raised from 6,000 to 41,000 bbl. daily.

Another substantial boost in United Kingdom refining capacity will be brought about with completion of the Coryton installation of Vacuum Oil Co., Ltd. The Coryton plant has an input rating of 20,000 bbl. per day and is to be equipped with catalytic cracking and thermal reforming facilities.

National Oil Refineries, Ltd., placed in service a 10,000-bbl. per day cat cracker during 1952. By 1955, National Oil Refineries plans to include a Platformer in the operating layout of its Wales plant.

A new two-stage distillation unit now under construction at the Hoo, North Rochester, plant of Berry Wiggins & Co., Ltd., will step up the refinery's capacity by 200 bbl. daily. Manchester Oil Refinery, Ltd., has under way a project for increasing its Trafford Park plant from 2,500 to 3,200 bbl. daily.

In Scotland, the William Briggs & Sons, Ltd., Dundee plant, which now processes topped crude oil, is to be equipped with new crude-oil-distillation facilities. The new facilities are to be set up for processing Venezuelan crude oil.

UNITED KINGDOM

England					
Berry, Wiggins & Co., Ltd., Field House Breams Buildings, Fetter Lane, London E. C. 4	Hoo, North Rochester	S	[1]2,200	.....	.....
	Weaste, Lancashire	S	1,250	.....	.....
Esso Petroleum Co., Ltd., 36 Queen Anne's Gate, London S. W. 1	Fawley	Comp.	140,000	6,000	41,000
Kent Oil Refineries, Ltd., Britannic House, Finsbury Circus, London E. C. 2	Isle of Grain	Comp.	81,000	.....	[2]10,000
Lobitos Oilfields, Ltd., 146 Dashwood House, Old Broad St., London E. C. 2	Ellsmere Port	Comp.	2,350	1,300	.....
Manchester Oil Refinery, Ltd., Twining Road, Trafford Park, Manchester 17	Trafford Park	S-L	[3]2,500	.....	.....
"Shell" Refining & Marketing Co., Ltd., Houndsditch, London E. 1	Heysham	S-C	33,000	[4]13,400	.....
"Shell" Refining & Marketing Co., Ltd., and Starhaven Refineries, Ltd., Houndsditch, London E. 1	Shell Haven	Comp.	60,000	[5][6]5,500	.....
	Stanlow	Comp.	85,000	[5][6]8,200	[7]25,000
Vacuum Oil Co., Ltd., Caxton House, Tothill Station, London S. W. 1	Coryton	(8)	.....	.....	.....
Total England			407,300	37,700	76,000
Scotland					
Starhaven Refineries, Ltd., Houndsditch, London E. 1	Ardrossan	(9)	.....	.....	.....
Scottish Oils, Ltd., 53 Bothwell St., Glasgow C. 2	Grangemouth	S-C	[10]50,000	[11]2,900	[12]10,000
	Pumpherston	S-C-W	[13]3,500	1,300	.....
William Briggs & Sons, Ltd., East Camperdown St., Dundee	Dundee	(14)	.....	.....	.....
Total Scotland			53,500	4,200	10,000
Wales					
National Oil Refineries, Ltd., Britannic House, Finsbury Circus, London E. C. 2	Llandarcy	Comp.	[15]80,000	(16)	[17]10,000
Total United Kingdom			540,800	41,900	96,000

(1) Includes added capacity for 1953. (2) Catalytic cracker to go into service in late 1953. Additional facilities include Platformer scheduled for 1954. (3) Includes added capacity for 1953. (4) Visbreaker capacity of 8,300 bbl. per day and reforming capacity of 5,100 bbl. per day. (5) Reforming capacity. (6) Capacity for reforming operation. (7) Catalytic cracking capacity. (8) New refinery under construction. (9) Refinery processes topped crude. (10) Includes 9,000-bbl. per day capacity supplied by thermal units operating in distillation service. (11) Idle capacity. (12) Catalytic cracking capacity. (13) Includes 2,400 bbl. per day of shale oil and 1,100 bbl. per day of indigenous crude oil. (14) Refinery processes topped crude oil. (15) Includes 12,000 bbl. per day of capacity supplied by thermal units operating in distillation service. (16) Thermal cracking capacity of three units, rated at 6,000 bbl. per day each, operating in other services. (17) Catalytic cracking capacity. Platformer to be installed in 1955.

UNITED STATES

The Oil and Gas Journal's Survey of United States refineries as of mid 1952 shows 329 operating plants. Total crude-oil input rating on these plants is 7,340,335 bbl. per day. Capacity on thermal operations including cracking, reforming, visbreaking and related operations is 2,235,160 bbl. daily for the 329 refineries. Combined processing capacity for catalytic operations in these operating refineries is 2,191,945 bbl. per day. A list of United States refineries as of January 1, 1952 was published in the Journal's Annual Refining issue, March 17, 1952.

U.S.S.R.

Dependable information via official sources on refining operations in U.S.S.R. is not available because of censorship. Estimates from reliable sources indicate there are about 29 operable refineries in Russia. Crude-oil input rating on these plants totals around 875,000 bbl. per day. Cracking facilities in these refineries include thermal processes and catalytic processes. Ratio of thermal to catalytic processes is high in favor of thermal. The known catalytic facilities in Russian refineries are of obsolete type since they were supplied under U. S. lend-lease in the early years of World War II. Total cracking capacity for Russia is estimated at 300,000 bbl. per day.

URUGUAY

Administracion Nacional de Combustibles, Alcohol y Portland, Castilla de Correo 1090, Montevideo	La Teja	S-A	25,200	[1]2,200

(1) Idle capacity.

Venezuela

A new refinery went on stream in Venezuela in 1952. The plant, operated by Phillips Oil Co., is rated at 2,000 bbl. per day crude-oil input. This new capacity plus increases brought about through process changes in existing refineries boosted Venezuela's total refining capacity by more than 100,000 bbl. daily.

Further expansion of capacity in Venezuelan refineries is scheduled. Creole Petroleum Corp. is to step up crude-oil input of its Amuay plant. Creole also has scheduled a 10,000-bbl. per day Hydroformer for Amuay. The Hydroformer is scheduled for 1955.

Shell Caribbean Petroleum Co. has under construction a project which will boost capacity of its Cordon refinery by 82,500 bbl. daily.

VENEZUELA

Colon Development Co., Ltd., Mijares a Mercedes 25, Caracas	La Rivera	S	200	
	El Calvario	S	200	
	Casigua	S	1,500	
Creole Petroleum Corp., Apartado 889, Caracas	Amuay	S	[1]75,000	[1]
	Caripito	S-C	63,000	[2]34,000
Mene Grande Oil Co., Apartado 709, Caracas	Cabimas	S	1,000	
Phillips Oil Co., Edificio Republica-Pte. Republica, Caracas	San Roque	S-W	2,000	
Shell Caribbean Petroleum Co., Apartado 809, Caracas	San Lorenzo	S	44,700	
	Cordon	S-C-L	[3]145,000	[4]40,500
Sinclair Oil & Refining Co., Apartado 1706, Caracas	Puerto la Cruz	S	[5]35,000	[2]13,500
Socony-Vacuum Oil Co., Apartado 246, Caracas	Guario	S	120	
Texas Petroleum Co., Tienda Honda a Punte 59, Caracas	Tucupita	S	10,000	
Venezuelan Gulf Refining Co.	Puerto la Cruz	S	40,000	
Total Venezuela			417,720	88,000

(1) Capacity to be increased and hydroformer added in 1955. (2) Visbreaking capacity. (3) Includes 82,500 bbl. per day of capacity to be added in 1953 but excludes current crude-oil input to thermal cracking unit and 7,000 bbl. per day heavy crude oil as cracking quench. (4) Includes 8,500 bbl. per day of reforming capacity. (5) Includes 5,000 bbl. per day of idle capacity.

YUGOSLAVIA

Official information on status of refineries in Yugoslavia is not currently available. Estimates indicate five plants with a total capacity of 8,000 bbl. per day are located in this country.

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Journal's International

SURVEY OF PIPE LINES

by Paul Reed
Pipe-Line Editor

IN pipe-line construction outside the United States this year, projects were completed totaling 2,330 miles. Products pipe lines led in this work with a total of 1,130 miles. However, crude-oil lines lead in projects currently under way with 1,600 miles. Natural-gas line projects of 7,000 miles are planned for the future.

Canada looms large in all classes of present and future foreign pipe lining. It exceeds other countries in the 670 miles of products lines laid this year; in the 811 miles of crude-oil lines under construction, and in the 6,170 miles

TABLE 1—PRINCIPAL FOREIGN CRUDE-OIL LINES PLANNED AND UNDER WAY

Company—	Miles	Inch	Status	Contractor, location, and completion date
Basrah Petroleum Co.	75	24	Under way	Zubair to Fao, Iraq.
Cia. de Petroleo Ganso Azul, Ltda.	48	4	Planned	Ganso Azul field to Pucalipa on Upper Ucayali River, Peru.
Creole Petroleum Corp.	143	26	Under way	Williams Bros. and Anderson Bros.—Ule to Amuay, Venezuela. June 1953.
Creole Petroleum Corp.	25	34	Planned	Lagunillas to La Salina, Venezuela. April 1953.
Direccion General de Yacimientos Petroliferos Fiscales	409		Under way	Plaza Huincul-Bahia Blanca, Argentina.
Interprovincial Pipe Line Co.	100	16	Contracted	Anderson International Contractors, Ltd.—Regina, Sask., to Gretna, Man.
Interprovincial Pipe Line Co.	135	24	Planned	Regina, Sask.-U. S. border.
Iraq Government	135	12	Planned	M. W. Kellogg Co.—Baiji to Baghdad, Iraq.
National Iranian Oil Co.	65	12	Planned	Lali to Masjid-i-Sulaiman and Kut-Abdullah to Zergan, Iran.
Petroleos Mexicanos	145	13	Planned	Reynosa to Monterrey, Mexico.
Petroleos Mexicanos	100		Planned	Istmus of Tehuantepec, Jose Colomo to El Plan field, Minatitlan, Mexico.
Petroleos Mexicanos	125	10	Under way	Jose Colomo to El Plan, Mexico.
Petroleos Mexicanos	72	12	Proposed	Poza Rica to Atzcapotzalco, Mexico.
Texas Petroleum Co.	19	4	Planned	Tetuan and Ortega fields to Guamo, Colombia.
Trans Mountain Oil Pipe Line Co.	711	24	Under way	Comstock Midwestern Ltd., and Mannix, Ltd.—Edmonton, Alta, via Yellowhead Pass to Vancouver, B. C.
Yacimientos Petroliferos Fiscales Bolivianos	170	4	Planned	Bermejo to Tupiza, Bolivia.

TABLE 2—PRINCIPAL FOREIGN PRODUCTS LINES PLANNED AND UNDER WAY

Company—	Miles	Inch	Status	Contractor, location, and completion date
Colombian Ministry of Petroleum	115	4	Begin 1953	La Dorada to Cartago, Colombia.
Colombian Ministry of Petroleum	93	8	Begin 1953	Cantimplora to La Dorado-Salgar, Colombia.
Empresa de Ferrocarriles Ecuatorianos	50	6	Under way	J. A. Jones and C. R. C. Engineering Co.—Guayaquil to Palmira, Ecuador.
Empresa Nacional del Petroleo	80	6	Planned	Concon to Santiago, Chile.
Governments of Southern Rhodesia and Portuguese East Africa	200		Planned	Beira, Portuguese Mozambique to Umtali, Southern Rhodesia.
Societe des Petroles au Congo (Petrocongo)	225	6	Under way	Ango Ango to Leopoldville, Belgian Congo. February 1953.
Petroleos Mexicanos	124	6	Planned	Lagos to Guadalajara.
Petroleos Mexicanos	54	6	Planned	Lagos to Aguascalientes.
Petroleos Mexicanos	82	8	Planned	Salamanca to Lagos.

TABLE 3—PRINCIPAL FOREIGN NATURAL-GAS LINES PLANNED AND UNDER WAY

Company—	Miles	Inch	Status	Contractor, location, and completion date
Azienda Generale Italiana Petroli	110	12-14-16	Start 11-52	Cortemaggiore to Genoa, Italy.
Azienda Generale Italiana Petroli	90	12	Under way	SNAM crews.—Cortemaggiore to Bologna, Italy.
Azienda Generale Italiana Petroli	120	16	Under way	Montubi.—Cremona Porto Mar to Ghera, Italy.
Azienda Generale Italiana Petroli	40	12	Under way	Montubi.—Ripaka to Bergamo, Italy.
Direccion General del Gas del Estado	310	8	Planned	Plaza Huincul to Neuquen, Argentina, to the vicinity to General Conesa, Argentina.
Empresa Nacional del Petroleo	80	10¾	Planned	Concon to Santiago, Chile.
Northwest Natural Gas Co.	950	24	Planned	Alberta fields to Vancouver, B. C., Seattle, Wash., and Portland, Ore.
Petroleos Mexicanos	205	16	Under way	Monterrey to Torreon, Mexico.
Petroleos Mexicanos	440	20	Planned	Brazil, Tampico, Poza Rica.
Trans-Canada Pipe Lines, Ltd.	2,247	14-30	Proposed	Alberta to Toronto and Montreal.
Trans-Canada Pipe Lines, Ltd.	747	8-24	Proposed	Gathering system in Alberta.
Westcoast Transmission Co., Ltd.	1,110	24	Planned	Ford, Bacon & Davis.—Dawson Creek, B. C., through Pine Pass and Fraser River Valley to Kamloops, Princeton and Vancouver, B. C., to Portland, Ore.
Westcoast Transmission Co., Ltd.	280	20	Planned	Ford, Bacon & Davis.—Pincher Creek to Montana on to Spokane, Wash.
Western Pipe Lines	833	24	Proposed	From southern Alberta, eastward across the Canadian prairies.

of natural-gas lines planned for the future. Even though some of these projects are conflicting proposals which may never materialize, Canada's gas program is still outstanding.

The longest foreign line now under construction is Trans Mountain Oil Pipe Line Co.'s 711-mile, 24-in. crude-oil line from Edmonton to Vancouver.

The Interprovincial Pipe Line Co. system will be extensively looped with big-inch pipe in the next few years to expand throughput from 83,500 bbl. daily in 1953 to an ultimate capacity between 200,000 and 300,000 bbl. daily. Interprovincial's Alberta crude will be transported to Sarnia, Ont., by a 635-mile, 30-in. extension to be built in 1953 from Superior, Wis., by Lakehead Pipe Line Co., an Interprovincial affiliate.

Following Canada in total of both lines under way and planned for the future, South America has 1,550 miles; Mexico, 1,350 miles; Europe and Africa, 800 miles; and the Middle East, 300 miles.

Not included in these figures are the proposals for building natural-gas lines from the Middle East to Europe which are still in preliminary stages.

Current foreign pipe laying amounting to 2,460 miles of lines under way plus future projects of 8,550 miles totals 11,010 miles. These include 2,400 miles of crude-oil lines, 1,050 miles of products lines, and 7,560 miles of natural-gas lines. Altogether these programs indicate substantial continued expansion.

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Le Havre-Paris Products Line Completed

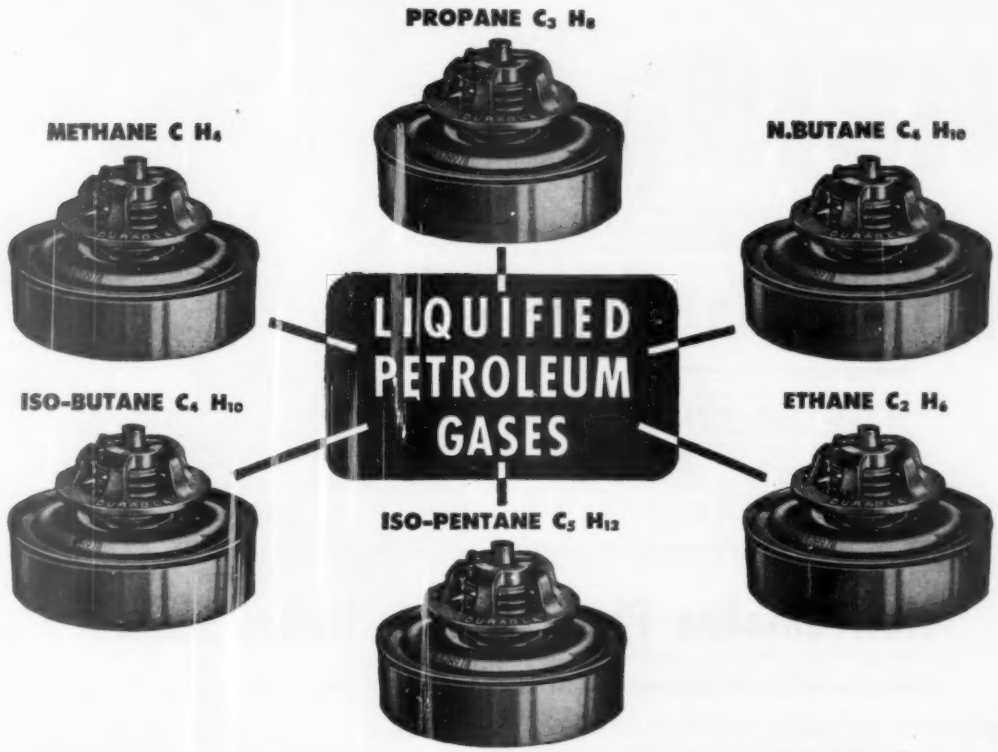
(Continued from page 198)

ventilation of the electrical motors is collected outside the pump room to be sure that it does not contain hydrocarbon vapors. Consequently, the electrical motors operating the pumps are separately ventilated and can be started only when this ventilation is in operation. The pumping stations are ventilated continuously with the air changed 20 times per hour. A difference of pressure is maintained between the pump room and the control room, and an automatic alarm is set off if this pressure is not maintained.

The percentage of hydrocarbon vapors in the atmosphere of pump room is continuously controlled, with automatic alarm if the percentage of inflammable vapors exceeds the predetermined value.

Control . . . The pumps are controlled from a control panel consisting of luminous dials, which automatically show the flow of the products at a given time, and a press button for starting or stopping the pumps. When the operator pushes the press button which starts one pump, the motorized intake valve opens in 90 seconds and the motor starts. Seventy seconds after achieving its normal rate of operation, the motorized discharge valve opens. Indication of any abnormality in the mechanical or hydraulic operation of the pumping station, manifold, or strainers appears on a dial at the control desk.

Characteristic of the Le Havre-Paris pipe line is the great complexity of the operations to be achieved, due to the variety of products to be transported and the number of tank farms to be supplied. The line will be put into operation in January 1953. It is to be hoped that the precautions taken in the planning and the construction of the pipe line itself, as well as of the pumping stations and of the terminals, will permit the solution of problems which may arise, and thus give complete satisfaction to the users.



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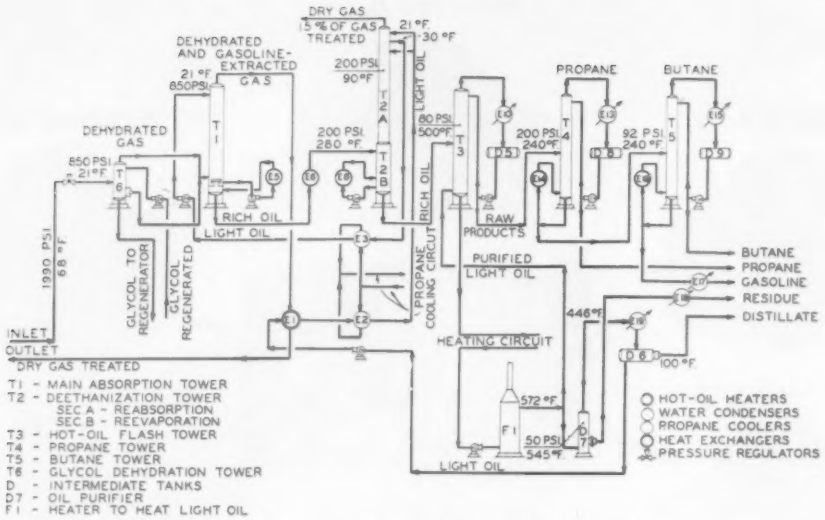


Schematic flow diagram of Cortemaggiore gasoline plant. Fig. 1.

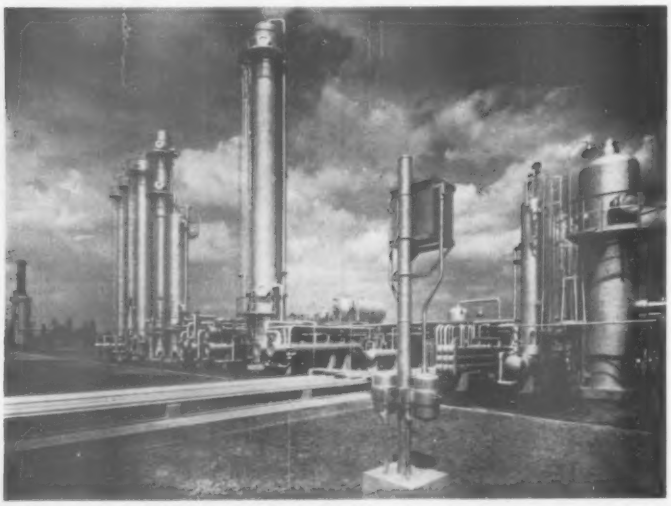
New Gasoline Plant Boon to Italian Market

Production of plant represents third of nation's requirements for high-grade fuel

THE Cortemaggiore gasoline plant of Azienda Generale Italiana Petroli (A.P.I.P.) has been in operation since March 1952. The plant processes gas from wells in Cortemaggiore field. It is located on a plat of 25 to 30 acres at the western extremity of the field.

The plant is designed to process 106 M.M.c.f. per day of gas of the approximate analysis:

	Per cent
Nitrogen	1.76
Methane	89.87
Ethane	4.40
Propane	1.57
Butane	0.77
Pentane and heavier	1.63



PROCESSING EQUIPMENT at Cortemaggiore plant. Main equipment includes, left to right, fractionation towers, absorption tower, and glycol dehydrator and regenerator.

The following products are obtained daily:

Propane and butane, bbl.	1,400
Gasoline, bbl.	1,275
Petroleum, bbl.	150
Residue, bbl.	120
Dry gas, M.M.c.f.	100

The extraction yield is 75 per cent for propane, 98 per cent for butane, and 99 per cent for the higher liquid fractions.

The produced gasoline, after stabilization, has an octane number, motor method, of 77. After addition of 5 cc. of tetraethyl lead, the octane number rises to 86 motor method and 88-90 research method.

Boon to Italian market . . . These quantities of propane, butane, and gasoline constitute significant proportions of the Italian requirements, which otherwise would have to be met in the main by refining imported crude oil. During the first 6 months of 1952, Italy's crude-oil production amounted to approximately 950 bbl. per day, while refinery runs averaged some 115,000 bbl. per day.

Italian gasoline requirements for the first half of 1952 were about 19,500 bbl. per day, some 4,000 bbl. of which was high-octane fuel (research octane number greater than 79). The Cortemaggiore production therefore represents nearly one-third of the requirements for high-grade fuel.

During the first 6 months of 1952 an

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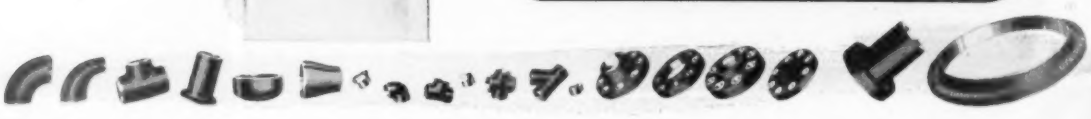

TO THE PEOPLE OF THE

CHEMICAL-PETROLEUM INDUSTRY

... all best wishes to you this Holiday Season and throughout the coming year.

CHEMICAL-PETROLEUM DIVISION

NATIONAL AIROIL BURNER CO., INC.

PHILADELPHIA • PENNSYLVANIA

HOUSTON • TEXAS

average of 2,940 bbl. per day of propane and butane was consumed in Italy. Of this quantity, 1,530 bbl. was produced by Italian refineries, the remainder being imported. Thus, the 1,400 bbl. per day obtainable at Cortemaggiore represents 47 per cent of the actual requirements of these products.

The availability of this liquefied petroleum gas on the Italian market will allow even further development of the use of these fuels. Italian consumption of L.P.G. is continually increasing.

Plant Processing

Gas entering the plant is first dehydrated. From the dehydrators, the gas stream is passed through an oil-absorption system, in which propane and higher hydrocarbons are substantially removed. Lean gas is then transmitted by pipe line to the industrial centers of northern Italy.

A flow diagram of the plant is shown in Fig. 1.

The gas is produced from the various wells at a pressure of about 2,420 psi. It is piped to six gathering centers and thence to the main collector at the plant. Plant inlet gas is at a pressure of 1,900 to 2,000 psi. and a temperature of 68° F.

Dehydration . . . The inlet gas is expanded to 850 psi. and fed into a glycol tower (T6). The expansion causes a cooling to 21° F. and a condensation of some of the higher hydrocarbons and water. The water is absorbed by the glycol.

The dehydrated gas, with a dew point lower than 23° F., comes out from the head of the tower T6. The condensed liquid hydrocarbons and the water diluted glycol gather in two distinctive layers at the bottom of the same tower.

The water-diluted glycol is sent to a regeneration installation from where it is recycled. The gas and the condensable hydrocarbons are combined and fed to an absorption tower (T1). The rich oil is collected at the bottom of the tower and, after having been heated to 194° F. (in E5) in order to be separated (inside of T1) from the dissolved methane and ethane, is admitted in the lower section of the tower (T2B).

Lean gas is passed through a heat exchanger (E1) and thence to pipe line.

Absorption . . . In T2B, where the separation of ethane and methane is completed, some higher hydrocarbons (especially propane) are also vaporized. This propane plus fraction is absorbed in refrigerated lean oil, this oil having been cooled in refrigeration unit (E2).

Small quantities of methane and ethane are recovered from the top of T2A. The rich oil passes from the bottom of T2B into the flash tower T3

Our customers also deserve an Otis service pin. As we approach our silver anniversary year we gratefully acknowledge *your* share in our progress . . . in making Otis the only organization in the Industry with a full complement of "pressure control" facilities — from manufacturing and marketing to field service crews which offer a large variety of services conducted "under pressure." Thank you for your part — for being our customers.

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which is heated by hot oil coming from the heater F1.

The distillation of rich oil occurs in the flash tower T3, with recovery of propane, butane, and gasoline through cooling system (E10), in tank (D5). Residual oil is removed at the bottom of the tower.

The mixture of gasoline, butane, and propane is charged to depropanizer column T4 in which propane is removed. The residue, made up of gasoline and butane, is admitted to debutanizer column (T5). Gasoline is recovered at the bottom.

The residual oil from the bottom of tower (T3) goes to heater (F1) after having supplied, through a series of exchangers, the heat necessary for the operation of the plant. Therein it is heated 572° F. A portion of this stream is sent to the flash tower, and the balance is sent to the purifier (D7).

The purifier divides the residual oil into two portions, one of which meets specifications of light oil used for absorption and is collected in tank (D6).

Other facilities . . . Besides the glycol dehydration system, the plant also has a cooling dehydration system. The natural gas from the gathering centers is expanded in a special tank (not shown on diagram). After the cooling due to the expansion, there is condensation of water and formation of hydrates, carried with the gas over heated coils. Here they decompose; the water is discharged from the bottom of the tank, and the separated liquid hydrocarbons and gas are sent to the absorption tower.

The circuit of the absorption oil (light oil) is as follows: The absorption oil coming from the storage tank (D6) passes through the exchanger (E1) and through the cooling system (E2) and from there it is carried to Section T2A of the deethanation tower.

T2A is divided at the top by a deflection plate. Thirty per cent of the light oil goes below the deflection plate for its function of reabsorption of propane and then, enriched, comes from the bottom of T2B. The remaining 70 per cent goes above the deflection plate where it contacts the up flow of methane and ethane. This stream then passes through the cooling system (E3) and thence to the head of the absorption tower (T1).

Cooling system . . . The two cooling systems (E2 and E3), where it is necessary to have very low temperatures, use as cooling means boiling liquid propane.

The operation of the propane cooling system, not shown in the diagram, is as follows: The liquid propane from a storage tank at 150 psi. is expanded in a vessel at 28 psi. The evaporation causes the cooling of the liquid to 10° F. The cold liquid propane from the bottom of the tank goes to the cooling systems (E2 and E3) where it undergoes a further evaporation and causes the cooling of the light absorption oil.

The propane vapor from the cooling systems then passes to the head of the expansion vessels where it is combined with the vapor formed during the first phase of evaporation. Combined vapor stream is sent to compressor, to cooler, and then again to the storage tank.

In cases where it is not necessary to have very low temperatures, water cooling is used. All the coolers and water condensers of finished products (E10, E13, E15, E17, E18, and E19) in Fig. 1, are fed by one forced-draft cooling tower.

The heating system is greatly simplified, since the use of steam has been eliminated. All heat requirements are supplied by hot absorption oil.

The use of compressors is almost completely eliminated. The plant has only a small air compressor for instruments, a small compressor to start the gas motors, and a compressor of 375 hp. for the propane cooling system.

All the control and regulating instruments of the plant are in a central location where the temperature, pressure, and flow are indicated.

The plant was designed and supplied by J. F. Pritchard & Co., of Kansas City, Mo.

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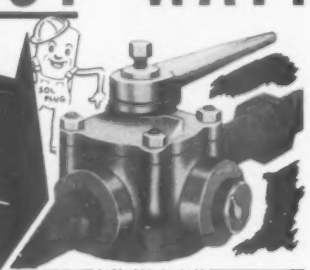

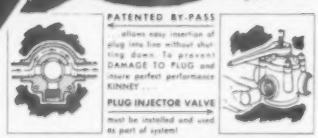
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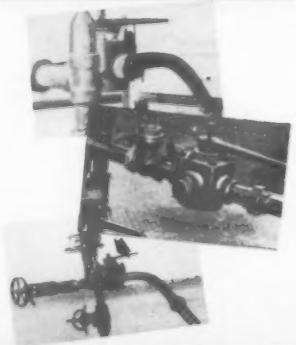

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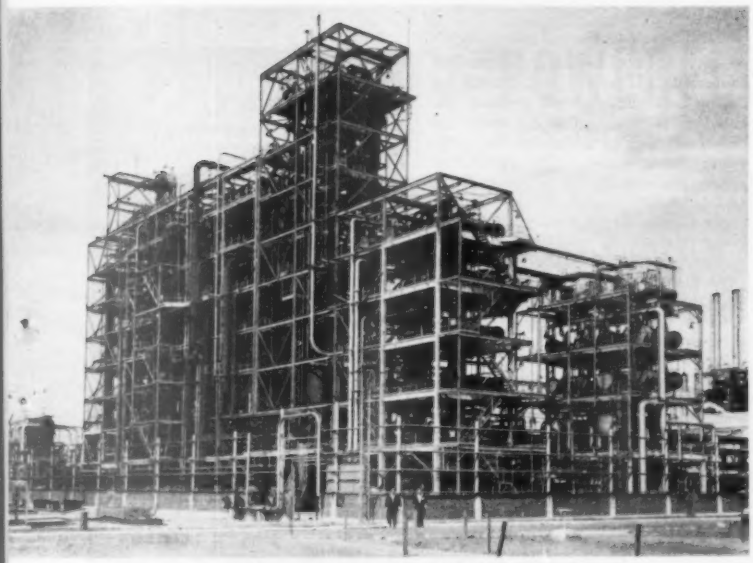


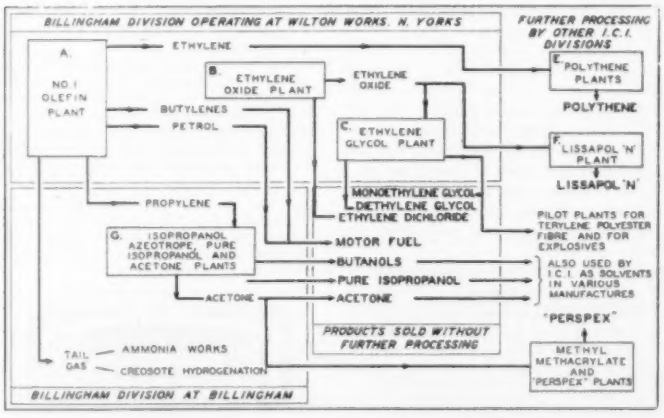
Gas-separation structure at the I.C.I. olefin plant at Wilton.

Britain's I.C.I. Operates Four Petrochemical Plants at Wilton

Large sections of most of units are in open air. All units are highly instrumented, and particular attention was given layout of the control rooms.

FOUR major divisions of British Imperial Chemical Industries, (I.C.I.) Ltd., operate plants at Wilton, North Yorkshire, England. They are the Alkali division, Billingham division, Dyestuffs division, and Plastics division.

The Billingham division operates four units: No. 1, olefin plant comprising respectively pyrolysis, gas-separation, and gasoline treatment sections; ethylene oxide plant; ethylene glycol plant, and formaldehyde plant.



Production of petrochemicals at Wilton Works and Billingham.

The pyrolysis unit has been purposely designed to run under a variety of operating conditions so as to give as much flexibility as possible. The feedstock rate may vary from 1 to 1.5 million barrels per year of light distillate oil, and the gasoline made from one-third to two-thirds of this amount. The designed output is over 30,000 tons per year of ethylene, and a similar quantity of propylene.

The formaldehyde plant operates independently of the rest, using as raw material refined methanol. Part of the formaldehyde is used in the phenol-formaldehyde and urea-formaldehyde resin plants operated by the Plastics division at Wilton, and part is transported to other I.C.I. factories.

Plant construction . . . Erection of all these plants was carried out by, or under the control of, the Wilton Works construction organization. The olefin plant was designed and engineered by M. W. Kellogg Co., of New York. Low Temperature Developments, Ltd., of London, did a similar job to the refrigeration sets of the ethylene oxide plant, and the evaporators on the glycol plant were executed by George Scott & Son (London) Ltd.

Main and subsidiary products made, and the interlinkage of the plants are illustrated in the flow diagram.

Large sections of most of the units are in the open air. All units are highly instrumented, and particular attention was paid to the design and layout of the control rooms. Ample space has been left between plants, except where two are operated together from a common control room, and form, in effect a simple unit.

Olefin plant . . . Outside the olefin plant are two large floating-roof tanks, each with a capacity of 2.75 million gallons feed-stock storage, four smaller refined gasoline storage tanks, link lines leading to the site from Teesport, the central control rooms, seven pressure-storage vessels for propylene and butylene, an extensive cooling-water system, the flare stack, and lime and chlorine off-loading.

In the pyrolysis section area of the olefin plant are steam heaters, oil heaters, pyrolysis control room, quench boilers and coolers, and the primary fractionator. The gas-compressing building houses direct-driven compressors for process gas and refrigeration. The control room operates the whole of the gas-separation train and associated refrigeration equipment located in the tall structure dominating the olefin plant.

There are several stages of gas fractionation at pressure and subatmospheric temperatures. The refrigeration system employs ammonia, three stages

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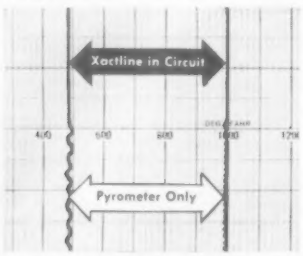

Exact reproduction of temperature chart for a heating process showing the comparison of the "Straight-Line" temperature control produced by XACTLINE and the saw-tooth curve obtained with only conventional control.

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of ethylene, and methane refrigeration in cascade. There are also systems for drying and purifying the process gas. Ethylene is produced at the very high degree of purity demanded for polythene manufacture. The propylene stream has a purity of 95 per cent.

The smaller gasoline section takes in crude debutanized gasoline and produces marketable gasoline, which is pumped to Billingham and disposed of from there.

Ethylene oxide . . . The ethylene oxide plant operates the now well-known chlorhydrin process. Chlorine and lime slurry are received from the offloading station, while ethylene is procured from the olefin plant via the two ethylene hortonspheres. There are two chlorhydrin towers, two saponifiers, a refrigeration set, and a distillation train. Ethylene oxide is stored in horizontal tanks.

The ethylene glycol plant reacts ethylene oxide with water at 300 psig. pressure and about 200° C. Aqueous glycol is initially concentrated in triple-effect evaporators and thence purified by distillation.

Formaldehyde unit . . . The formaldehyde plant employs a single large "burner" for the oxidation of methanol with silver granule as catalyst. A compact layout, a high degree of automatic control, and good heat economy form cardinal features of this plant.

Work will shortly begin in the area of land bounded on two sides by the olefin works offices and No. 1 olefin plant, on the erection of a paraxylene plant which, with the glycol unit, will furnish the two main organic raw materials for "Terylene" manufacture at Wilton. The vacant site to the west of No. 1 olefin plant is reserved, if required, for No. 2 olefin plant.

New plants . . . Two new polythene plants are under construction. Also, the ethylene oxide and glycol plants have been laid out so as to facilitate duplication, if needed. The olefin plant stream referred to as Butylenes in the diagram is, in fact, a complex mixture of 4-atom hydrocarbons containing not only iso and normal butylenes, but also significant amounts of butadiene at a concentration sufficiently high to permit of economic extraction. Projects for its extraction and utilization are being developed.

A new plant under construction at Wilton by the General Chemicals Division of I.C.I. is for the manufacture of caustic soda and chlorine by electrolysis of brine. The ethylene oxide plant will draw its chlorine direct from this unit when it is completed, instead of liquid chlorine being brought to Wilton in rail tanks.

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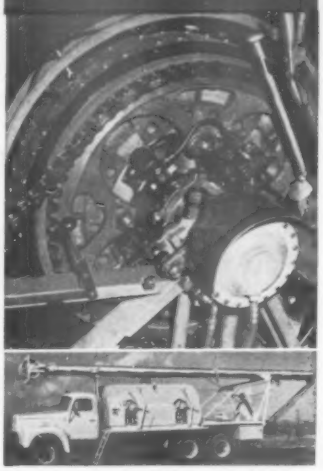

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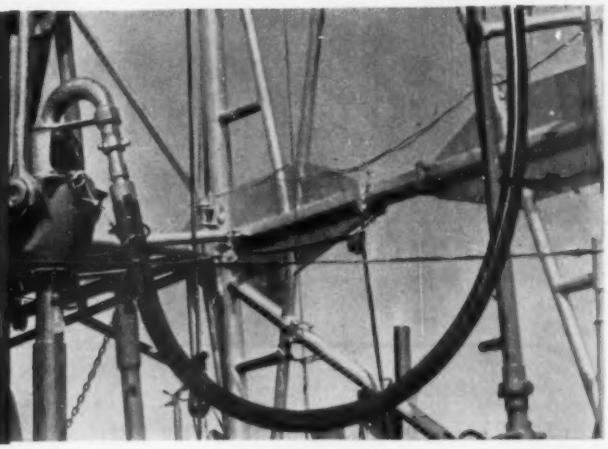

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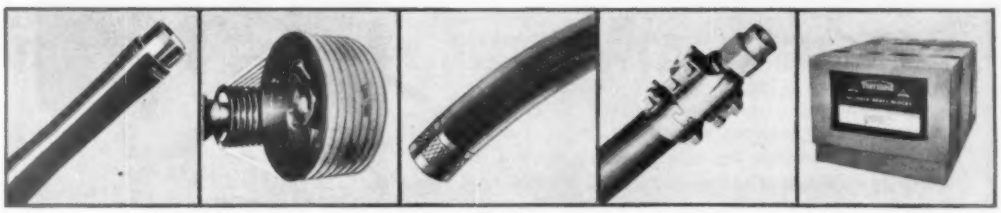

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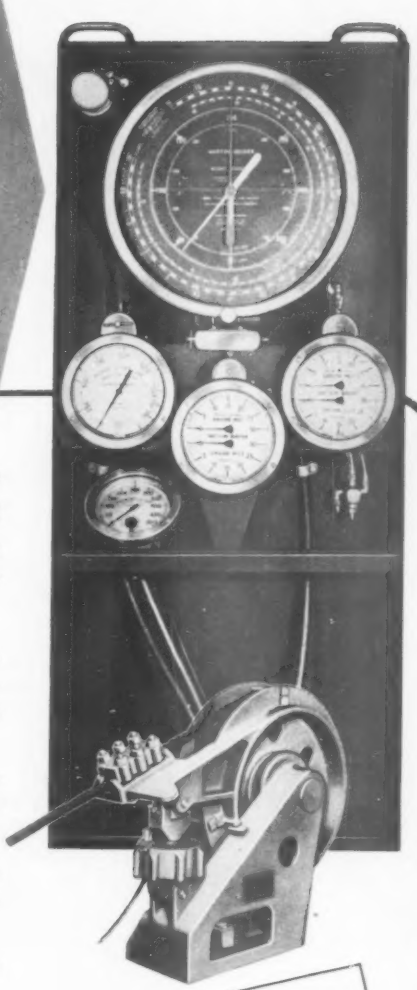

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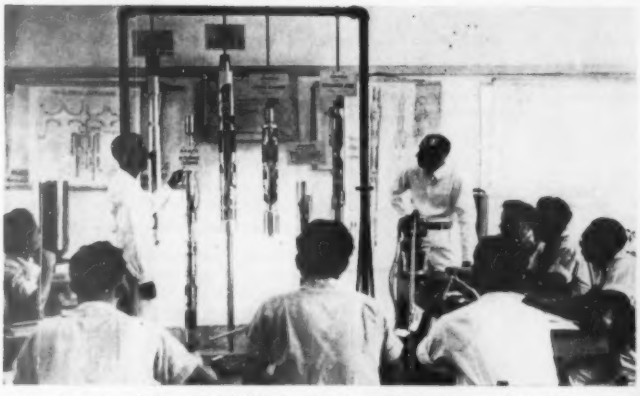
Petroleum Technical School at Prabumulih



At top is a view of the school buildings, while immediately above students learn something about cement retainers and mechanical drawing.

Trains Indonesians for Specific Occupations

Permanent teachers are attached to the school, while specialists from industry, such as a geologist, chemist, surveyor, etc., are available for special subjects

IN the center of the oil fields in South Sumatra, at Prabumulih, is situated the Petroleum Technical School of the N. V., De Bataafsche Petroleum Maatschappij (a company in the Royal Dutch-Shell group) founded in 1950 to continue the work of a similar institute set up in 1940 in the region of Balikpapan (Borneo).

Some considerable time ago the need was felt of incorporating in the personnel of the oil industry young Indonesian workers, who, instead of learning by practical experience alone, would have the opportunity of laying a firm foundation for their future as employes of the oil industry by a preliminary systematic theoretical training, coupled with efficient practical exercise.

The Petroleum Technical School, whose course lasts 2 years, is specially focused on the training of those Indonesian pupils who, after a technical, secondary technical, or secondary education, desire to fit themselves for specific posts in the oil industry.

The school, which has boarding facilities, trains pupils for the posts of driller, field mechanic, assistant exploitation engineer, and assistant geologist. The program for the school year 1952-53 also includes training for assistant topographer.

Facilities . . . The school has at its disposal a school building consisting of classrooms, a drawing room, a laboratory, and a model room. The laboratory is intended for the practical work of chemistry lessons, and for carrying out qualitative and quantitative analyses and titrations; it is also equipped as a workshop for making models.

In the model room are assembled the principal auxiliaries and instruments in the field of drilling and production, and these, together with a collection of "cut-away" models of the most complicated drilling aparatus, form the instructional material for lessons in the technical subjects. Several models, for example of a drilling site with complete drilling rig and a crude oil collecting station with a separation plant for oil, gas and water, which considerably facilitate teaching in the first year of the course, are also installed there.

The geological instructional material consists of an extensive collection of formation samples obtained from exploration wells, rock samples, ores, etc., which have partly been placed at the disposal of the school by the Technological Institute, Bandoeng, or collected during excursions to Bangka, Tandjong Enim, Pagar Alam, etc.

The geological teaching aids also include various block diagrams which help the future assistants to the field geologists and the exploitation engineers to form the requisite picture of the geological makeup of oil structures. The showing of 16-mm. films and slides connected with training also takes place in the large model room.

In the first course, as in the second, which began in mid-October 1951, the training of the assistant exploitation engineer, assistant field geologist, driller, and field mechanic groups was undertaken. In all 24 and 22 pupils respectively took part in these courses.

In August 1952 the first pupils graduated from the school.

Before a pupil is accepted, a good basic education is required; candidates are tested as to their knowledge, and besides a medical examination, they also undergo psychological tests.

Curriculum . . . The aim of the curriculum is to impart to the pupils the theoretical knowledge required for their future posts and to prepare them by practical training to carry out the work attached thereto. This requires a carefully chosen alternation of theoretical and practical periods, the proportion of which depends on the nature of the positions they are to occupy. For this purpose a syllabus is followed in which the subject matter for tuition is described and guidance is given for systematic practical study in the various branches of the undertaking.

The theoretical side comprises an amplification of the basic knowledge of mathematics, mechanics, physics, and chemistry, and after the first term the exact sciences are applied to problems occurring in the industry.

Lessons are also given in geology, surveying, the theory of drilling and producing, and the technical aspects of installations and materials, mechanical engineering, etc. In the practical work both mechanical drawing and cartography are studied, together with the drawing of geological charts, macroscopic and microscopic examination of rock samples, drill cutting and core samples, topographical measurements and the calculation thereof, training with geological tools, the assembling and dismantling of drilling and production apparatus, steam equipment, motors, cable and rope connections, etc.

With the general subjects attention is devoted in the theoretical period to language, to teach pupils to master the nomenclature of the oil industry and to use their language better. Various lessons are devoted to industrial hygiene to give the pupils an idea of first aid and the general health problems which may occur in work in the fields or on the sites.

Training methods . . . Since it is considered of the greatest importance, in associating with workers, that future supervisory personnel have an understanding of the correct method of instructing workers and the solution of their problems and that they have a critical eye for the working methods to be followed, the guiding principles behind supervisory training are at the same time dealt with, and instruction is also given in the field of safety regulations, office work, and the drawing up of reports.

A number of permanent teachers are attached to the school, whilst specialists from the industry, such as a geologist, a reservoir engineer, a surveyor, a chemist, a production expert, an architect, a doctor, etc., are available for teaching the special subjects.

The school has boarding facilities with places for 48 pupils; the wing for the first-year pupils consists of two dormitories, each containing 12 pupils, while the second-year pupils are housed in eight rooms, each intended for 3 pupils. There is a common room for reading and study, a dining room, and a recreation room for indoor sport.

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Field Processing of Arabian Crude Oil

(Continued from page 169)

4-ft. 6-in. by 150-ft. vessels are used, with two vessels operated in parallel at about 800 psi., as the first stage, and the remaining vessels in series as successive pressure stages at pressures between 380 and 10 psi. On all installations primary process control is effected by level controllers on the oil inlet to each vessel.

Subsequent developments at Dammam by Aramco consisted of a duplication of the original first and second stage vessels in January 1941. No additional third-stage capacity was provided as the three vessels originally installed had proved adequate to take care of anticipated surges, and were still considered more than adequate as separators. In 1945, after a second visit and further investigation of the Anglo-Iranian installations at Haft Kel and Gach Saran by members of the field producing organization, it was concluded that the third increment of Dammam trap capacity, then being designed, should be of the horizontal type.

A capacity of 70,000 bbl. per day was desired for the new facilities. To achieve this, four 4 by 60-ft. vessels (the greatest length considered practicable to ship already fabricated) were selected, two for the 335-lb. and two for the 140-lb. stage. One hundred and twenty feet of separating travel was provided in each stage by means of gas and liquid crossovers joining the two vessels. Essentially, then, each stage consisted of two vessels in series with well effluent or first-stage trap effluent entering the first vessel and gas and liquid leaving the second vessel at the ends opposite from the crossovers.

The capacity of the originally installed 9 by 30-ft. surge drums would have been exceeded at a throughput of 90,000 bbl. per day, so a fourth 9 by 30-ft. vessel was installed, and oil from the new horizontal, first and second-stage traps also was put through the battery. However, with completion of the 50,00-bbl. per day Ras Tanura refinery, and the underwater pipe line to Bahrein Island, two major outlets had developed for sour oil, and it was no longer necessary to remove H_2S from the entire Dammam production. Consequently, a 10,000-bbl. spheroid was also provided as part of this final increment of trap capacity to serve the dual purpose of an essentially atmospheric pressure separator and a surge tank for excess production.

The latest Dammam development is the separation of facilities into two systems—one for wet oil and the other for dry oil. This was simplified by the incremental nature of original construction, the vertical units now being used for wet oil production.

Horizontal Separators at Abqaiq and Qatif

In contrast to Dammam, where separator development was tied very closely to requirements of the stabilization facilities, at Abqaiq and Qatif the first separators were developed simply to provide a degassed oil which, although sour, was of low enough vapor pressure to be pumped and stored with a minimum of hazard.

The initial Qatif installation followed closely the installation of the first horizontal separators at Dammam. This was a two-stage vertical setting employing a 45 by 40 ft. (11,000 bbl.) cone-roof tank for final atmospheric separation and gaging. For a long period only one well was connected, and the setting was operated primarily to obtain data for future production separator design. The first large-production setting was not built at Qatif until early in 1948, but in the meantime facilities at Abqaiq were completed which more than tripled the oil output of Saudi Arabia.

Abqaiq . . . Less than a year from the date that the first horizontal traps in Arabia were placed in service at Dammam, the No. 1 gas-oil separator plant was operating at Abqaiq. The same size first and second-stage vessels as at Dammam were used, but here the similarity between installations ends. Major differences were called for because of a gas-oil ratio almost double that at Dammam, higher well-head pressures and the greater capacity desired. On the basis of theoretical gravity separation, a parallel arrangement of vessels was found to have considerable advantage over the series arrangement with crossovers as used at Dammam. However, with parallel vessels the problem of level control using motor valves located on the vessel outlets and the problem of distributing the inlet flow makes for somewhat more complicated operation.

It was felt that the necessity for regulating closely the production of each individual well precluded use of the more easily operable inlet control of levels which had been adopted by Anglo--Iranian, especially since outlet control had proved satisfactory even in the short period of Dammam horizontal trap operation. Thus, a parallel-series combination of nine vessels arranged in four pressure stages was adopted—three 4 by 60-ft., 500-psi. vessels in parallel for the first stage, two 4 by 60-ft., 150-psi. vessels in parallel for the second stage, three 9 by 60-ft., 65-psi. vessels in parallel for the third stage, and a 10,000-bbl. spheroid for final atmospheric pressure separation.

The parallel arrangement of vessels in each stage later proved so difficult to operate at high rates that all subsequent designs utilized but a single vessel per stage, wherever possible.

Two practices incorporated in the first of the Abqaiq units are still part of the most modern Aramco separating plant. One is the use of gas expansion turbines for oil pumping. Cold gas from the high-pressure stage of separation is used where the amount of power available is adequate; however, in many instances superheating in fired heaters and expansion to lower pressures than possible with cold gas is necessary to develop the required output. It has been found that sufficient energy is available in the superheated, 500-lb. gas from 100,000 bbl. per day production to transfer the oil as required within the unit and to pump it over a 12-in. pipe line a distance of almost 40 miles.

The other practice is in regard to the use of internals in the separating vessels. Practice on internals follows Anglo-Iranian designs in which internals were deleted on the basis that separator conditions approximate more closely the existence of gas bubbles in a stream of oil than oil droplets in a flow of gas. To facilitate the simple gravity separation, only a surge baffle at the oil level and an inlet distribution baffle were provided in the first vessels. The only improvements made in the ensuing 6-year period, after a number of tests and much design and experimental work, have been the addition of simple drawoff devices to the gas and oil outlets.

Production from Abqaiq was actually taken prior to completion of the first separator plant or any pumping facilities. Material procurement was a very great handicap to all construction performed during that period. During 1945 the pipe line from Abqaiq to Dhahran was laid acros the intervening 10 miles of salt flats and undulating dunes. That December the first 500-lb. separating vessel arrived in the field and was connected temporarily to three of the five completed wells.

With makeshift controls, the oil effluent was turned directly into the pipe line which terminated in a spheroid designed to operate at a maximum of 10 psi. For 2 or 3 months, until additional equipment arrived and could be installed, 20,000 to 30,000 bl. of oil daily was produced under these conditions.

During the 2-year period following completion of the first Abqaiq gas-oil separating unit in May 1946, three additional 100,000-bbl. per day units were constructed. The fifth unit was completed in May 1950. Progress in design was as rapid as this progress in

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construction, with continual emphasis on simplification of required operating procedures, provision of greater overload capacity and improved performance of instrumentation.

The fifth 100,000-bbl. per day Abqaiq unit, installed at No. 3 gas-oil separator plant, is a plant which represents 5 years' continuous improvement in high-rate horizontal separator design. Single horizontal vessels 120 ft. in length were used in each of the first three stages of the fifth unit. All of these vessels were shipped to Arabia completely fabricated. Previously, to avoid additional heavy lift and special handling charges, maximum shipping length had been restricted to 60 ft. This required a circumferencial field weld at the middle of each 120-ft. vessel, and in the case of the high-pressure vessel had made it necessary to build an oven around the vessel after welding for the stress-relieving operation.

Valving separator units . . . In the interest of simplified operation and the prevention of serious upsets due to valve failures, which were not unusual in view of the vibration associated with flows of flashing liquid and high velocity wet gas, dual motor valves were used for the first time in all essential services. These were sized for high overloads, with allowance for anticipated entrainment. Gas and oil piping also which, in some of the previous installations, had become limiting at high rates, was similarly sized. The dual gas relief valves on second and third-stage vessels were sized for relief of increased amounts of gas which would accompany bypassing of the upstream trap due to a liquid outlet control valve failing open.

The fire load, even with a 120-ft. vessel, is of very little significance. It does not add enough to the required relieving capacity based on the process load alone to make an increase in valve size necessary. This is because the gas evolved with normal throughputs and fire is only slightly greater than normal, due to the amount of heat required to raise the temperature of the large volume of liquid flowing through the trap. With blocked discharge, less vapor is generated due to heat input from the greatest probable fire exposure than is evolved during normal operation.

Locked plug cocks were provided under each relief valve, as it was considered that a single valve would provide enough protection to allow a leaking valve or a valve scheduled for testing to be removed and replaced during operation. Protection against high level and liquid pressuring of any vessel, such as might occur from the liquid outlet valve failing shut and which could not be handled by a relief system designed for gas, was provided for by a two-element (level and pressure) controller which closed an emergency valve on the inlet of the high-pressure trap. In addition, emergency flow-line shutoff valves were provided by means of which all flow into the plant area or any individual well could be shut down from the control house and a number of other locations in the plant.

A great deal of work and experimentation on back-pressure control resulted in the installation of dual, angle-type valves plus a bypass for each stage. These valves were selected primarily because improved flow conditions over the conventional globe type body were expected to reduce the extremely high noise level. The oppressive noise had previously resulted in locating the back-pressure control station at the edge of plot limits, some 500 ft. from the unit. These expectations were realized to a great extent; however, it was still felt justified for future installations to keep the back-pressure control station in its remote location. To minimize the inconvenience of location, all back-pressure controllers were installed with provision for changing the set pressure from the control house.

Other improvements were the adoption of overhead lines to prevent the accumulation of wind-blown sand and a buried header type of flare tip designed to reduce the smoke and glare nuisance. An additional feature of the improved flare tip was that, being buried, it was not subject to the intense radiant and convection heat of the flame. Expensive plant shutdowns for repair of burned flare tips of the old type or the equally expensive alternative installation of a standby flare line up to 2,500 ft. long were both eliminated thereby.

Because of the many significant design improvements incorporated in the fifth Abqaiq unit, No. 3 gas-oil separator plant was the first separator plant which did not require full-time American supervision. This was considered a major step toward the Aramco goal of maximum Saudi Arab participation in operation of the oil enterprise.

Further Separator Development

The second separating unit at Qatif, which is located at the No. 1 gas-oil separator plant in that field, was built concurrently with the third Abqaiq unit. It was not of a particularly advanced design. However, from its performance it is evident that it is more conservatively rated and operates closer to the optimum of equilibrium separating conditions than do the Abqaiq units. Very little entrainment difficulty has been experienced, and the maximum capacity has not been determined. When the second unit was completed the original vertical unit was converted for well testing.

The most recently installed Qatif separator units consist of commercially available horizontal vessels assembled as a "packaged unit," complete with control valves and all appurtenances. Since these units were not designed by Aramco, very little design information is available. And, in the short time they have been operated, the only field report is that their operation has been satisfactory.

At Ain Dar the development of gas-oil separator plants suited to conditions existing in the great new Ghawar field was begun. There are now four 100,000-bbl. per day units in operation and two more are scheduled for completion before the first quarter of 1954. Each of these comprises a separate plant, since it has been determined that there is little economy in running flow lines a great distance to a central plant of 200,000-bbl. per day capacity, as at Abqaiq. Fundamentally, this is an outgrowth of the elimination of direct American supervision, for Arab operators live at the outlying stations with but a few of the amenities to which the American has grown accustomed.

Ain Dar flow lines . . . Besides retaining the desirable simplified operating features which make all-Arab operation possible, the Ain Dar plants have established some features of their own. One of these is the aboveground flow line. At Abqaiq No. 3 gas-oil separator plant all flow lines were buried in order to minimize installation and maintenance costs. However, a great number of the earlier Abqaiq flow lines were laid aboveground.

After a study, based on Abqaiq conditions, of various methods for recovering the more valuable of the fractions which escaped with the separated gas, it was obvious that cooling prior to separation of the well effluent, which often entered the station as high as 170° F., was very attractive as a direct means of retaining these fractions in the liquid state. Aboveground flow lines, by realizing air coling which averaged 35° F. over the year, effected a very worth-while conservation of resources.

Other Ain Dar developments have been toward reducing initial cost. With the establishment of a number of separating plants in an area, operating flexibility is greatly improved. It is no longer so essential that the later plants be designed for as high a degree of reliability as was built into the original units, for production losses from one plant can usually be made up by increasing slightly the production from others. Also, initial development of a

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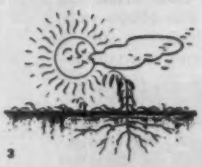

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field such as Ain Dar requires overdesign of separating facilities and a greater capacity than will be desirable for the ultimate production of the reservoir.

These facts were realized in the design of Ain Dar No. 4 gas-oil separator plant and a number of economies effected. First, the installation of dual control valves in all gas and oil services and the provision of dual relief valves was eliminated. Dual valves had been primarily intended to increase the operating factor when first adopted at Abqaiq, although some improvement in overload performance also resulted. They became a more costly insurance provision than was considered warranted for the fourth Ain Dar unit.

Experience with the inlet shutoff valve on the high-pressure trap led to the conclusion that in many respects this valve was duplicating functions which could be performed just as well by the emergency shutoff valves on each flow line. Consequently, at Ain Dar No. 4 gas-oil separator plant this valve was deleted and the high-level and overpressure pilots on each separating vessel were arranged to shut down all flow lines coming into the trap area instead.

A final measure of economy was achieved by eliminating the multiple flare lines previously considered necessary. In earlier installations the low and intermediate-stage gas and gas from the test facilities was flared through one line while high-pressure gas, gas-turbine exhaust, relief-valve discharges, and spheroid gas was disposed of by another. A 24-in. and a 30-in. line were required. By combining, a single 30-in. line was adequate. Such a combination was made possible both by the increasing availability of large size pipe and the buried-type flare tip, which required no more frequent maintenance than was afforded during routine plant shutdowns for test and inspection.

Recent gas-oil separator-plant installations, complete with pumping facilities and all utilities but excluding flow lines, have been costing in the neighborhood of $1,500,000. It is anticipated that Ain Dar No. 4 gas-oil separator plant will be significantly less expensive than this. For purposes of comparison with United States costs, it is a general rule of thumb that Arabian construction costs are twice those in this country. However, to offset the high plant cost, operating costs of such an installation are correspondingly low, a recent average figure being about $3 per 1,000 bbl., including the cost of repairs.

Future Possibilities

The greatest promise for future trap development in Arabia appears to lie in the application of centrifugal separating principles. Present methods of separation accept gravity as a constant factor in the calculation of residence time. However, it is known that the gravity effect can be increased manyfold centrifugally. If R = separation index, G = gravity, T = time, seconds, the effectiveness of separation is a function of these variabels, or R = f (G, T).

In the gravity separator as now employed, G is equal to unity. If a satisfactory separation index were 125 for simple gravity separation, and the oil could be subjected to an acceleration of 100G for 1¼ seconds, the separating effect might possibly be the same. Only the vessel required would be a great deal smaller. This principle has been employed in some small, vertical separators and is embodied in the tangential inlets on Anglo-Iranian units at Agha Jari. However, only very slight increases in acceleration are developed. A small, high acceleration test unit patented by Aramco showed some promise, but has not yet been carried to the point of full-scale application. A vane element placed in the nozzle of one horizontal test trap in Abqaiq resulted in a capacity increase of 70 per cent. Experiments are being continued along these lines.

Another possibility being studied is the use of smaller-capacity central stations. Even though it is estimated that a 50,000-bbl. per day plant would cost 80 per cent as much as the present 100,000-bbl. per day unit, offsetting savings in well and flow-line costs may be realized. Depending upon the degree of communication in the reservoir, it may be possible to bunch wells closely around such a station and provide them with large flow lines which would give a very high potential per well. This would require a minimum of investment in wells and lines.

Unattended stations and completely electrified installations are also being considered as possibilities.

Dhahran, Abqaiq, and Ras Tanura Stabilizers

In the terminology of Aramco field plants, what is called a stabilizer is essentially an atmospheric weathering column, having steam-heated reboilers, designed to remove propanes and the lighter hydrocarbons from crude oil. Removal of propane also effects satisfactory removal of hydrogen sulfide. The degree of weathering is controlled entriely by controlling the steam rate to the reboilers, which in turn controls the bottom temperature.

Saudi Arabian crude oil contains from 75 to 850 p.p.m. of dissolved hydrogen sulfide, the average being 250 p.p.m. It is presently considered necessary to reduce the H_2S content of crude to be shipped offshore in tankers to a maximum of 10 p.p.m. Otherwise a serious hazard would exist aboard ship from accumulation of highly toxic hydrogen sulfide around the tank vents. The reduction of vapor pressure accompanying stabilization is sufficient to prevent evolution of excess hydrocarbon vapors and the resultant explosion hazard.

Stabilizers are installed at Dhahran, Ras Tanura (in the refinery), and Abqaiq, with rated capacities of 175,000, 85,000, and 540,000 bbl. per day, respectively.

Unit rating . . . The Dhahran units were constructed in increments corresponding generally to the production increases of Dammam field and the initial operations at Abqaiq. They consist of two 7 by 45-ft., 15-tray columns, originally designed for a capacity of 17,000 bbl. per day each, but subsequently modified for a combined throughput of 60,000 bbl. per day, and one 12-ft. 6-in. by 46-ft. 6-in., 15-tray column. The large column is rated at 115,000 bbl. per day, likewise a substantial increase over the original design capacity.

The Ras Tanura unit contains two 7-ft. columns, formerly located at Dhahran, which have a slightly greater capacity in their new location because bottom-feed preheaters were used and some further equipment modifications incorporated in their installation. Dismantling of the last two 7-ft. Dhahran stabilizer columns is scheduled for the later part of this year, after which they will be moved to Ras Tanura for use as part of a new crude topping unit. Dhahran stabilizer capacity then will be reduced to 115,000 bbl. per day.

By their nature and because of their close association with other producing facilities, stabilizers have generally been considered as field plants and are fed with crude oil from the field in which they are located. However, in no case is this true without qualification. In fact, there are some excellent reasons why a stabilizer should be located at the point of offtake instead of in the producing fields, particularly if outlets exist for both stabilized and unstabilized oil, as they do at Ras Tanura.

The Dhahran stabilizer feeds oil produced from Dammam field, plus a certain amount from Abqaiq and/or Ain Dar. All of the Qatif production which is stabilized is stabilized at Ras Tanura plus some Abqaiq and Ain Dar and possibly Dammam. The Abqaiq stabilizer feeds only production from Abqaiq and Ain Dar.

Crude handling . . . No segregation of crudes of different gravity is attempted, but by taking advantage of inherent

(Continued on page 340)

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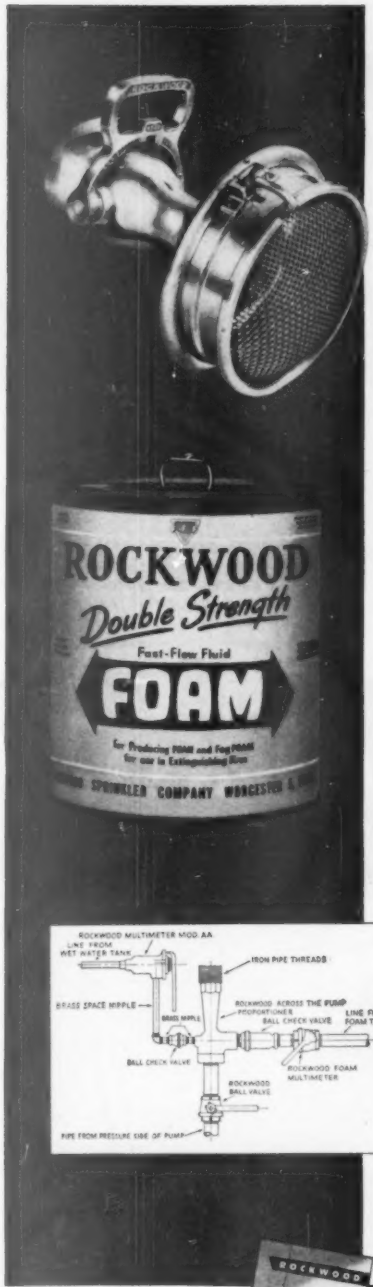

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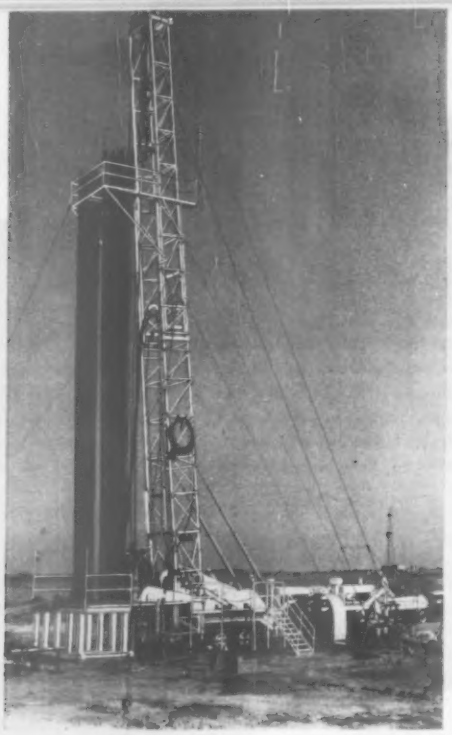

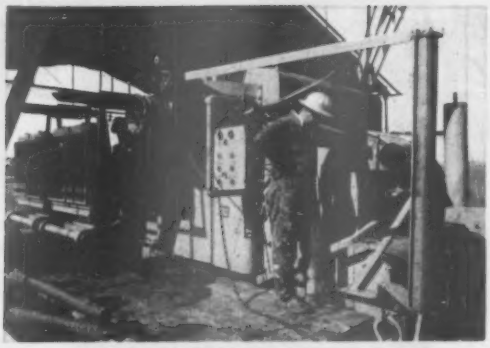

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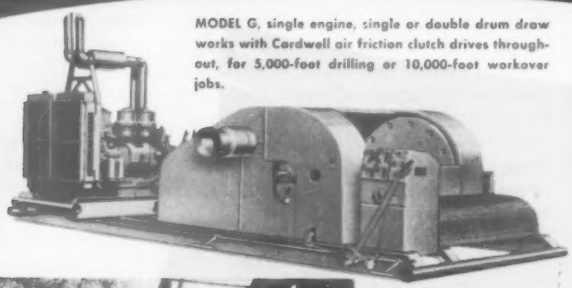

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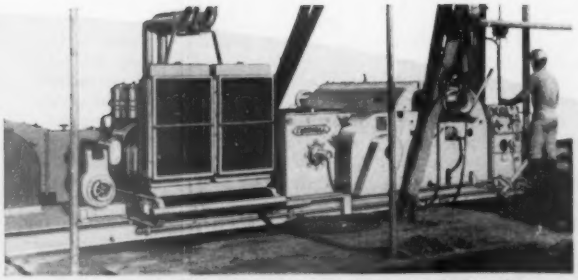

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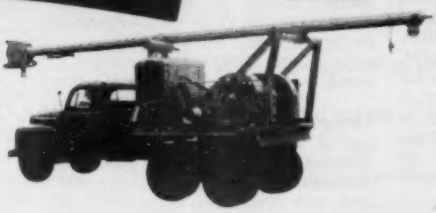

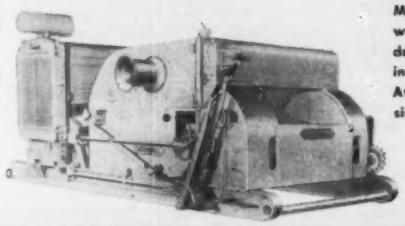

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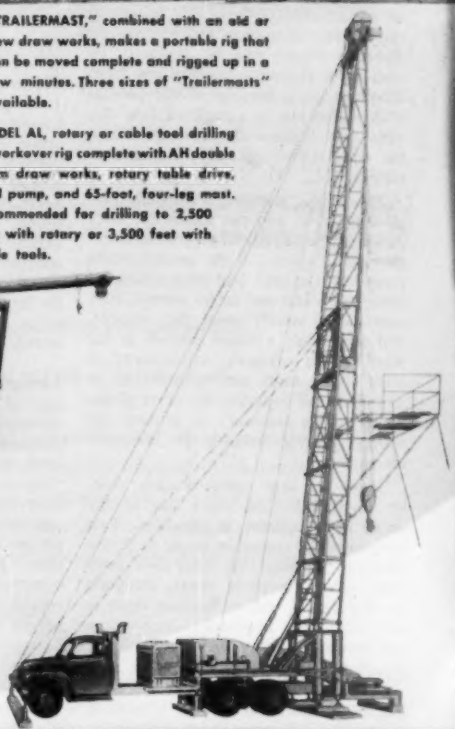

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pipe-line flexibility it is possible to equalize the gravity of stabilized crude at all outlets. Stabilization reduces the vapor pressure to 3.0-3.5 R.v.p., with a loss in gravity of somewhat less than 1.0° A.P.I. Consequently, sour crude shipped offshore via pipe line is held 0.7° to 1.0° A.P.I. higher in gravity than stabilized crude for tanker shipment from Ras Tanura or deliveries to Tapline for offtake at Sidon.

To accomplish this, it is apparent that stabilizer, pipe line, and producing capacity in and between the areas of operation must be maintained in reasonable balance. Attaining the best balance possible has necessitated making two major moves of equipment originally installed at Dhahran. The first relocation became desirable as a measure of increased flexibility when it was demonstrated that modifications could effect great increases in the Dhahran stabilizer capacity and after certain pipe-line additions brought sour oil into Ras Tanura directly from Abqaiq in amounts exceeding the refinery capacity.

The present dismantling was considered attractive because boat shipments of stabilized crude from Ras Tanura to the Bahrein Petroleum Co. refinery on Bahrein Island will be replaced by sour-crude shipments via pipe line from Dhahran when looping of the present underwater line is completed late this year, and because the columns could be used advantageously in another service.

The Abqaiq stabilizer units were built principally to process somewhat over 300,000 bbl. per day of oil for shipment through Tapline. With modifications completed last year, including additional bottoms coolers and larger pumps, they now handle nearly twice this amount, and can supply a major portion of the Ras Tanura offshore requirement as well. These units are operated at or near their full capacity, the other plants being run as necessary to provide the proper gravity balance as discussed above.

There are four columns 12-ft. 6-in. by 46-ft. 6-in., the same size as the single large column at Dhahran. Two have one-half crossflow trays, as in the Dhahran column; the later two have one-quarter crossflow trays, designed for high-liquid traffic. Because there is very little water at Abqaiq, the bottoms are cooled by large banks of fin-fan forced-air circulation exchangers.

Capacity differences . . . It is interesting to note the difference in capacity of the two types of columns. On individual test, the columns with one-quarter crossflow trays proved capable of sweetening 157,000 bbl. per day each, and the columns with the one-half crossflow trays would handle 135,000 bbl. per day each. The combined Abqaiq plant capacity is less than the sum of these figures because other limitations are imposed by some of the common equipment when all columns are operated together. In addition, plant capacity is affected by entering crude temperature, which varies with the season of the year.

Data for Ras Tanura, where the temperature variation between winter and summer is greatest, show that the capacity is increased 5,000-6,000 bbl. per day by the higher summer feed temperatures. Feed temperature also influences the amount of H_2S in the feed, the amount flashed on the feed tray, and the degree of stripping in the column at a given bottom temperature. It has been reported by the operators that during the hot summer days the bottom temperature must be increased as the feed temperature rises to maintain a sweet product. This would indicate that degree of stripping has a major influence on product quality since the vapor rate in the tower section of the column at a given bottoms temperature decreases with an increase in feed temperature.

The original three 7-ft. stabilizer columns installed at Dhahran were provided with compressors and a rectifier to process the overhead vapor for a 90 per cent recovery of pentanes. Liquid product was returned to the crude. When the 12-ft. 6-in. stabilizer column was built, the plant design included a rectifier unit, but this was never installed. Subsequently, it was found that enough excess capacity existed in the original compressors and rectifier column to realize substantial liquid recoveries from the overhead of the large stabilizer column also, and that of a fourth 7-ft. column eventually installed.

Low-pressure operation . . . In the design of the Abqaiq unit a number of alternate proposals for stabilization at pressures up to 400 psi. were considered, with comparison on the basis of ultimate future installation of gasoline recovery equipment. It was found that pressure stabilization would be of greater cost both initially and ultimately than atmospheric stabilization with compressors, so the columns were designed for a nominal 50 psi. This will permit operation of the Abqaiq stabilizer at 20 psi., which is planned upon completion of the gas-injection facilities now under construction.

Higher pressure operation is expected to show a recovery of 45 per cent of the pentanes now lost to the flare when the feed is from tankage and 65 per cent when feed is taken directly from the low-pressure traps. An increase in the column pressure involves some slight loss in capacity, however. Several methods of regaining this loss are under investigation. One is the development of controls which will allow operating the reboiler at the minimum temperature necessary to meet the H_2S specification. At present, with an allowable 10 p.p.m. H_2S content, the average product test is less than 5 p.p.m.

Storage facilities . . . Another interesting aspect of the crude oil handling problem related to stabilization is that of storage facilities. Field storage of both stabilized and unstabilized oil is accomplished by means of floating-roof tanks. But when the problem of storing unstabilized oil at Abqaiq and Dhahran was first encountered, the practicality of this solution was not apparent.

The Reid vapor pressure of the sour crude varies between 4 and 10 lb. This oil, when shipped via underwater pipe line to Ras Tanura or Bahrein Island presented no storage problem because its vapor pressure was reduced as it cooled in the pipe line. However, it was feared that further weathering in field tankage would present a serious H_2S hazard if oil were pumped to storage directly from the final stage of separation. It was concluded that the unstabilized oil would require additional separation in a vessel operating below atmospheric pressure.

While the subatmospheric designs were in progress, temporary sour-crude storage was provided at both Abqaiq and Dhahran in gas-blanketed, cone-roof tanks, without breather valves, which were connected to a high vent stack. Also, experiments were performed to determine quantitatively the extent of the hazard involved in floating roof storage. After it was demonstrated that the hazard was not sufficiently great to warrant additional crude processing, work on the subatmospheric trap project was discontinued.

In all probability the cone roofs of the first sour-crude storage tanks will be replaced, when they require it, with floating roofs.

A significant final step in processing Arabian crude oil is now being taken at Abqaiq. Construction is under way on a gas-injection unit which will return 150 million standard cubic feet per day to the formation in this field. Although market requirements are such that recovery of liquefied petroleum gas cannot be justified financially at the present time, the new plant will replenish the reservoir to the extent that such ultimately recoverable light ends are replaced. And gas disposal, as it has been practiced since the start of production, will have become a thing of the past.

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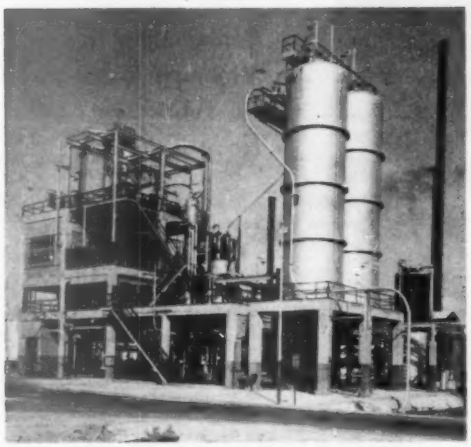

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Ad 70J

Heavy-Oil Production In Boscan Field

(Continued from page 171)

tween night and day. Accordingly, it has been found that 2 p.m. is the best and 6 a.m. the worst, for transporting the crude.

Upon entering a storage tank located at one of the five gathering stations situated throughout Boscan field, the crude is heated to a temperature of approximately 195° F. by steam coils located within the tanks. The effect of this necessary heat treatment is to make the crude froth to such an extent that only one-half of the tank capacity can be utilized for storage.

From the storage tanks the crude is pumped into an 18-in. buried main line which transports the crude 24 miles to the loading station adjacent to Lake Maracaibo. Midway upon this 24-mile journey the crude is heated from 100°-160° F. at a heating station which applies the heat through steam-operated heat exchangers.

In spite of the fact that the 18-in. line is buried, heavy tropical rains still noticeably effect the transport efficiency of the line.

Another anomaly pertaining to the transportation of the crude arises concerning pumping pressures. It has been found that, contrary to normal fluid mechanics, within certain limits the less volume pumped through the line the greater the resulting pressure drop. This is due to the larger amount of heat loss incurred by the necessary longer time required in transit.

Crude storage . . . Depending upon the pumping rate, the crude arrives at the loading station at temperatures varying from 120°-135° F. At the loading station the crude is received in one of four 80,000-bbl. tanks to await shipment. Once again the crude is heated, this time to approximately 150° F. by means of steam coils within the tanks.

When shipment is required the crude is pumped 1½ miles through either of two parallel 18-in. submarine lines which are manifolded so as to permit a complete circulation path between the storage tank and the loading dock. This circulation is maintained between shipments in order to keep the crude oil at the lowest possible viscosity.

All of the tankers involved in shipping Boscan crude to market are equipped with steam coils in their cargo compartments by which the crude is kept at an average temperature of 140° F. while at sea.

As aforementioned, the heating of Boscan crude while it is in gathering station tanks results in a high degree of frothing. Because of this froth, which only allows one-half of the tank to be filled with actual crude, conventional gaging is virtually impossible. Therefore, production gaging is usually done by weigh meters, thus allowing the production volumes to be computed by weight. These weigh meters are calibrated against test tanks where the froth is allowed to settle. It usually takes about 4 days for the froth to disperse.

Various chemicals have been tried in order to decrease the surface tension of the fluid and thereby minimize the collection of froth, but as of this writing the costs incurred have been prohibitive for commercial operation.

Tank gaging . . . It has been found that even when the froth element is not present, as is the case at the 80,000-bbl. storage tanks, it is impractical to use conventional sounding methods for determining volumes. This is because the viscosity of the crude prevents getting a plumb-bob to the bottom of the tank. Subsequently the ullage method is being is being used in gaging of the above nature.

Whenever it is desired to obtain depth pressure recordings, another problem arises by virtue of the nature of the Boscan crude. Due to the viscosity of the crude, it is impractical to run depth pressure-recording bombs on conventional wire lines, either in the tubing, annulus, or open hole of a Boscan well. Consequently, in order to obtain the desired data, an assembly, consisting of three joints of line pipe, which is designed as a sinker with a cage at the bottom containing a depth pressure recorder, often in tandem, is lowered into the hole. If static and pumping pressures are desired, a special cage is constructed on the standing valve and the recorder is run in on rods.

This type of test is usually done with a 72-hour clock in the recorder. In order to take pumping recordings at depths greater than that at which the pump is set, a special cage containing the recording bomb is assembled on sucker rods which are in turn attached to the bottom of a gas anchor and extend to the desired recording level. This of course, necessitates pulling both the rods and tubing from the hole in order to recover the recorder.

The occasional presence of sand and water in crude obtained from Boscan field presents major operational obstacles.

The sand is being systematically eliminated at its source by a constant workover program which entails the cleaning of the well bore and the flushing out of sand with Bunker C fuel oil.

However, water remains a problem by virtue of the fact that the specific gravity of Boscan crude is so close to that of water, thus making the economical dehydration of tank oil an impossibility as of this writing.

Socony Reduces Drilling Time in Guario

(Continued from page 173)

used with no apparent increase in the amount of weight that could be carried on the bit without causing the hole to deviate.

Drilling results . . . Summarizing the results of this information, it appeared that the best procedure for increasing rate of penetration would be to increase the weight on the bit and allow the hole to deviate updip.

There were two main objections offered to this program:

1. Increased wear on the drill collars and more danger of drill-pipe failures.
2. It was felt that it would be impossible to place the bottom of the well at the desired spot without resorting to expensive directional-drilling techniques. This was a serious objection due to the nature of the reservoir which made it important to bottom the hole as close to the oil-water contact as possible.

In order to determine the validity of these objections, photoclinometer surveys were run in two wells. These surveys showed the wells had been deviated almost directly updip. There was no indication of key seating, or, of the well bore following a tight spiral. As the above-mentioned items are the chief cause of drill-pipe failures and stuck drill pipe, it was concluded that little, if any, difficulty need be expected from this source. As to increased drill-pipe wear, it was pointed out that the reduction in rotating hours would more than offset the increased wear due to an increased deviation.

To counter the second objective (placing the bottom of the well at the desired location), it was proposed that all wells could be assumed to drift updip and the magnitude of the drift to be that given by the straight-hole tests. Comparison of the results calculated in this manner and calculated from the photoclinometer survey indicated differences of the order of 5 per cent could be expected. Therefore, if the coordinates of the bottom of the hole were chosen, and a given deviation program were decided upon, the surface location could then be calculated and the deviation program followed by merely controlling the bit weight.

New drilling technique . . . Fig. 2 shows the average penetration rate plotted as a function of (30° — formation dip + 2 average deviation) for the wells that

have been drilled since this relationship was derived.

G-39 was the first well in which the technique of allowing the hole to drift appreciably upstructure was used. This well was drilled to a total depth of 5,380 ft. with a maximum deviation of 3½°. The objective sand was found to be wet and it was decided to plug back and sidetrack the hole, allowing a horizontal drift of 528 ft. A cement plug was placed 2,183-2,366 ft., and after allowing the cement to set, sidetracking commenced. Fig. 3 shows the difference in rotating hours required to drill the interval in the original and sidetracked holes. It will be noted that 427 fewer rotating hours were required for drilling the sidetracked hole.

Following the success in deviating Guario-39 within a few feet of programed position with a marked reduction in drilling time, all subsequent wells were located at the surface to allow for a deviation program to bottom the well where required. The result was a great saving in time. Fig. 4 shows the time required to drill the well in days (including time taken to set surface casing) the well depths, the maximum deviation and the formation dip. The effect of increasing the allowable deviation is clearly seen from Fig. 4.

No difficulty was encountered in bottoming the hole where it was desired. Table 1 shows the assumption

TABLE 1

	Assumed drift		Actual drift	
Well—	Amount (ft.)	Bearing	Amount (ft.)	Bearing
G-39 (sidetracked)	528	348	531	346
G-40	401	295	395	303
G-41	232	103	233	118
G-42	401	290	393	288
G-43	232	162	202	156

regarding magnitude and azimuth of drift which were made for the purpose of spotting the location on the surface and the results obtained from deviation surveys. The close agreement between the assumed and actual results is noteworthy.

Equipment used . . . Equipment used to achieve these results was ordinary drilling equipment, i.e., no directional-drilling equipment was used. Casing program was to set 9⅝-in. surface pipe at about 1,000 ft. and 6 or 4½-in. casing at total depth. In drilling the surface hole three 8-in. drill collars were used and for the remainder of the hole 8⅝-in. bits were run on bottom of six to twelve 6⅛-in. o.d. drill collars. Drill pipe used was 4½-in., 16.6-lb. equipped with full-hole tool joints. Oil-emulsion mud with an oil content of 15-20 per cent was used from G-34 onwards. Both reciprocating and rotating-type scratchers have been used on the oil strings and there has been no difficulty in moving the pipe in the desired manner. There has been no evidence of unsatisfactory cementations, and while all deviated holes are flowing naturally no production troubles have been experienced.

Search for Production In Trinidad

(Continued from page 175)

to explore the Lower Cretaceous sequence. The well was abandoned at 10,695 ft.

Two more recent Cretaceous tests ended in failure. These were Trinidad Leaseholds, Ltd.'s, Marac-1 and Trinidad Petroleum Development Co.'s New Grant well.

At present one exploration well, with a target of 15,000 ft., is being drilled by Apex (Trinidad) Oilfields, Ltd., and a Cretaceous test at Moruga is being drilled by Trinidad Petroleum Development Co. Two other Cretaceous wells are planned, one in the Central Range and the other at Oropouche.

The other exploration wells currently drilling have the Herrera sandstone as their target and are located in the Coora, Moruga, and Ortoire basin areas; in addition there is deep outstep testing for the Herrera in Penal and Barrackpore.

In the three exploration areas mentioned above, there have been some encouraging results recently. In the Ortoire, United British Oilfields of Trinidad, (a member of the Shell Group) found oil-bearing Herrera sands at comparatively shallow depths. Search for commercial production in this area is being intensified.

Further deep Herrera drilling is planned in the Trinity Hill area by another company.

Eocene prospects are not rated highly, and are only of secondary importance as an exploration target. Sections penetrated consist mainly of shale. Some production is being obtained from Mount Moriah sands in a few wells in the Guapo-Brighton area. When tested in the Marabella well above 2,000 ft. these sands yielded only a small quantity of brackish water with traces of oil. United British Oilfields of Trinidad, Ltd., found subcommercial production in these sands at depth in their well FW-214 at Point Fortin.

Four companies have just completed seismic surveys in their prospective areas, and one field geological party and one seismic party are at present active in the Ortoire. Several companies are now considering additional seismic and field party work.

New company . . . A point of some interest is the entry of a new company on the Trinidad scene. Dominion Oil, Ltd., is actively leasing in the northern part of the island in the Chaguanas area and also in the Nariva area, and is now carrying out geological work. A seismic survey is also projected.

For a number of years the shallow Gulf of Paria has offered prospects for marine drilling, and the Trinidad Government has now granted the leases.

Trinidad's westernmost producing fields are known to extend into the gulf, and on the Venezuelan side, in Pedernales field, Miocene wells with high rates of production have been drilled. In 1951 there were nine wells in this field with a total potential of over 9,000 bbl. per day. It is therefore hoped to find similar Miocene structures in the gulf, with the possibility of deeper Oligocene and Cretaceous production as additional incentives.

Undersea completion . . . The first undersea completion was carried out by Kern Trinidad Oilfields, Ltd.'s, in March 1951, by directional drilling from a shore location at Guapo. Results were encouraging, and 12 wells have been similarly drilled offshore from the Guapo and Brighton fields by two companies.

A joint marine seismic survey has just been completed in the southern part of the Gulf of Paria for combined companies, and this is the first step toward marine exploration drilling from platform and barge in the near future.

Dominion Oil, Ltd., intends to carry out a similar survey in the northern part of the Gulf of Paria.

Production history . . . Trinidad's annual production reached its peak of 22 million barrels in 1940, since then it has been slightly below that figure, the lowest being 20.1 million barrels recorded in 1948. Crude-oil production in 1951 totaled 20,842,716 bbl.

Over the past 6 years production has remained remarkably steady, showing only very small annual changes. It has been maintained at this level by active drilling in the existing development areas. At the end of 1951, 27 strings were in operation, of which 8 were drilling deep tests.

During the same 6 year period, annual completions have been fairly constant, averaging 144 per year. The total footage drilled in 1951 was 664,687 ft., slightly above average. Shallow targets are becoming exhausted and the trend is towards deeper drilling. The average depth of wells completed in 1951 was 4,481 ft. compared to 3,700 ft. in 1940; 19 wells were drilled to 8,000 ft. or deeper.

A.I.O.C. Building 60,000-Bbl. Refinery at Kwinana, Australia

Plant will produce about 55,000 bbl. per day of refined products, with over half being fuel oil

ON October 1 work began on the site of Anglo-Iranian Oil Co.'s new Kwinana refinery, 12 miles from Fremantle, Western Australia. Planned to be completed by the end of 1955, the $90,000,000 refinery will have a capacity of 60,000 bbl. per day of crude oil and is expected to supply about 40 per cent of Australia's then estimated annual requirements. It will be the largest refinery in Australia.

Since the standstill at Anglo-Iranian's Abadan refinery last year, the company has been obliged to obtain oil products from the Western Hemisphere for shipment to Australasia to satisfy the demand. A refinery at Laverton, near Melbourne, operated by Commonwealth Oil Refineries, Ltd., has supplied a small part of the country's requirements, but its capacity is only some 2,500 bbl. daily. With transport from the Western Hemisphere uneconomical, the company decided to build another refinery in Australia.

The geographic position of Western Australia influenced the choice of site. Large tankers will carry crude oil from the Middle East and smaller tankers will take the refined products to the eastern Australian ports and New Zealand.

With the assistance of the Western Australian authorities the Kwinana site was eventually chosen by Anglo-Iranian's experts sent from England. Situated on Cockburn Sound, about 12 miles south of Fremantle, one of Australia's main bunkering ports, it can easily be connected by rail and pipe line with both Perth and Fremantle. The existing road connections are excellent.

About 900 acres of comparatively level land covered with light scrub, well above sea level, with good load-bearing properties, offers an ideal site for industry. Alongside is sheltered deep water where the biggest tankers will be able to maneuver and dock at any state of the tide.

The project consists of three major elements:

1. The refinery and its ancillary services, with a capacity for processing 3 million tons of crude oil a year.

2. The port, capable of importing 3 million tons of crude oil a year and exporting from the refinery the proportion of finished products to be dispatched by tanker.

3. A complete township which will include houses for the company's employes together with amenities, shops, ancillary industries, and all normal municipal facilities. This will be a state government responsibility.

Main contractors will be M. W. Kellogg Co. and its British registered subsidiary, Kellogg International Corp., in association with a consortium of British contractors headed by Costain-John Brown.

Five main units, all of the latest design, will comprise the refinery plant. Key items will be two atmospheric distillation units complete with stabilizers, solutizers, and soda washers. There will also be a vacuum distillation unit, a catalytic cracking unit, a Platforming unit, a Hydroforming unit, and the necessary number of small treatment units for sweetening and final treatment of the products.

The refinery will produce about 55,000 bbl. per day of refined products, comprising in its early stages at least, the main products needed for the Australasian market.

Fuel oil will comprise the largest bulk product, about 28,000 bbl. being produced daily. Other principal products will be 15,000 bbl. of gasoline, 9,000 bbl. of diesel oil, 7,500 bbl. of gas oil, and 1,200 bbl. each of aviation turbine fuel and kerosine.

Cooling water for the processes will be taken from the sea, about 2.5 million gallons per hour being needed. After circulation this water will be discharged back into Cockburn Sound, maximum precautions being taken to insure that no oil is allowed to escape into the sea. An additional 3 million gallons a day of fresh water for use in the refinery and for domestic purposes will be drawn from municipal sources.

Steam for the refinery will be generated in four water-tube boilers, the capacity of each being 75,000 lb. per hour. More than 60 tanks will be built in the tank farm adjacent to the refinery.

These men will direct building and operation of Kwinana project . . .

A. E. MASON
General manager of the Kwinana project for A.I.O.C.

D. W. K. BARKER
Manager of A.I.O.C.'s Australian division, refineries department

H. J. W. BRADDICK
London project superintendent for the Kwinana project

C. H. E. REBBECK
Resident engineer for A.I.O.C. on the Kwinana project

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Here's one of hundreds of actual Western performance records . . . This well* was originally potentialed for 100 barrels per day, but production soon fell below allowable. After **WESTERN** analysis and treatment, potential was boosted to 265 barrels per day! A year later production was *still* well above allowable.

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Gulf Coast Drill Log

Contractor: Kerr-McGee Oil Industries, Inc.

Operator: Kerr-McGee Oil Industries, Inc.

Well: Continental Land & Fur Co. 1, South Gibson area.

Location: Section 55-17s-15e, Terrebonne Parish, Louisiana.

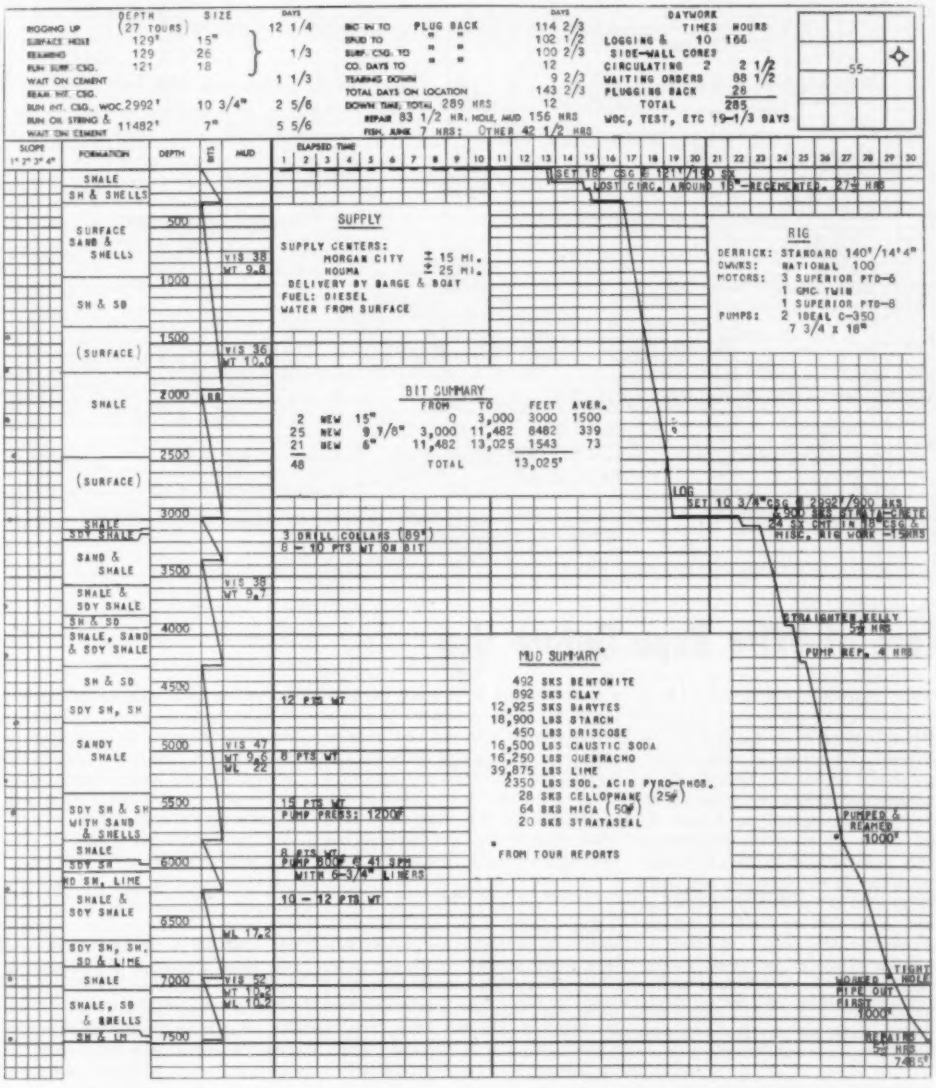
	DEPTH (27 TOURS)	SIZE	DAYS
RIGGING UP			12 1/4
SURFACE HOLE	129'	15"	
REAMING	129	26	1/3
RUN SURF. CSG.	121	18	
WAIT ON CEMENT			1 1/3
REAM INT. CSG.			
RUN INT. CSG., WOC	2992'	10 3/4"	2 5/6
RUN OIL STRING & WAIT ON CEMENT	11482'	7"	5 5/6

	DAYS
RIG IN TO	114 2/3
SPUD TO	102 1/2
SURF. CSG. TO	100 2/3
CO. DAYS TO	12
TEARING DOWN	9 2/3
TOTAL DAYS ON LOCATION	143 2/3
DOWN TIME, TOTAL 289 HRS	12
REPAIR 83 1/2 HR. HOLE, MUD 156 HRS	
FISH, JUNK 7 HRS; OTHER 42 1/2 HRS	

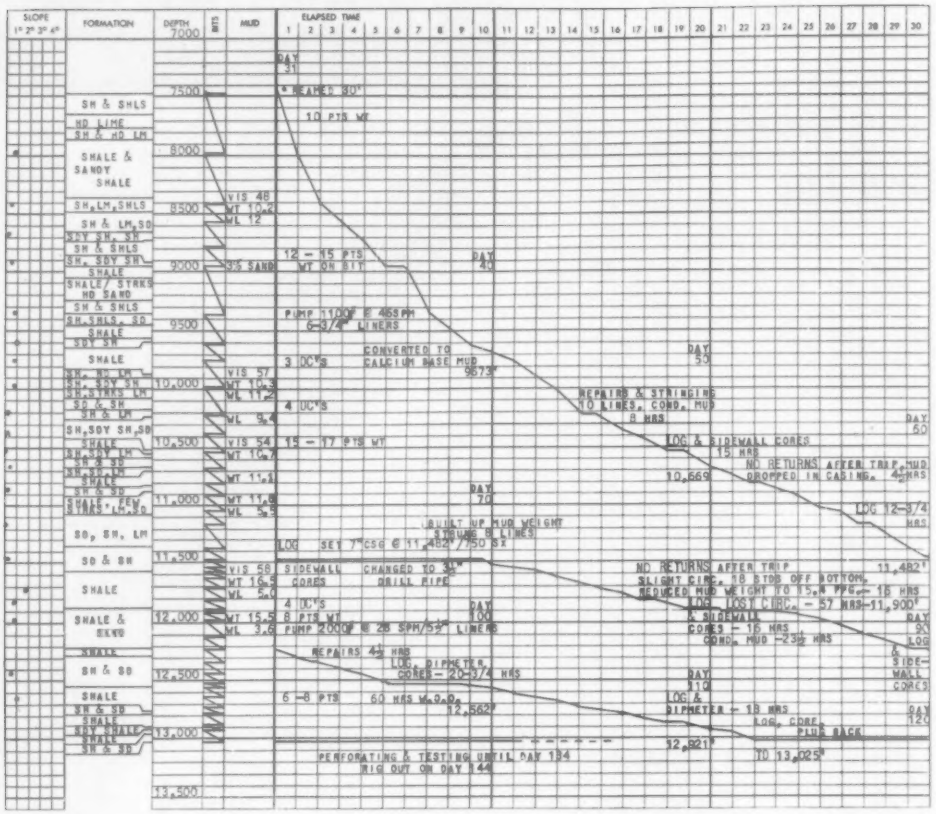
PLUG BACK " "

DAYWORK	TIMES	HOURS
LOGGING &	10	166
SIDE-WALL CORES		
CIRCULATING	2	2 1/2
WAITING ORDERS	88	1/2
PLUGGING BACK	28	
TOTAL	285	

WOC, TEST, ETC 19-1/3 DAYS



Gulf Coast Drill Log—(Continued)



Care of Wire Rope Before Use

THE correct handling of a wire rope before use is very essential if best results in its use are to be obtained. Wire rope is complicated and should be handled accordingly.

Wire rope arrives on the job either in a coil, or wound on a reel. It will no doubt reach its destination in a railroad car or truck. When unloading do not drop the reel onto the ground or platform. The heavy rope might shift its position or from its inertia alone cause the reel to collapse. This might damage the rope, or it could be damaged in the difficult operation of removal from a collapsed reel. If in a coil the rope might be bent enough to give it a permanent set. Do not roll reels or coils over very stony ground. The weight may cause sharp rocks to indent the rope. A bar used to roll a reel will do the same thing if it bears against the rope. Instead use the bar against the flange.

*From Bulletin C-51, Use and Care of Wire Rope, Leschen & Sons Rope Co.

Storing

Reels and coils are generally stored for a period before installation. They should be placed under cover if possible or at least kept clean and dry and protected from the weather. Do not keep rope in a place that can be reached by acid fumes or other corrosive agents. If the rope is to remain in storage for some time, it is advisable to cover it with waterproof paper. As received it is frequently factory covered with a "protector" which will preserve it for a long time. Otherwise, the outer layer should be covered with a good rope lubricant.

If used rope is put into storage, the same precautions should be taken to protect it from corrosion. In addition it should be thoroughly cleaned and given a coating of lubricant. It should be wound on a reel and not coiled loosely on the ground or floor. Do not pile heavy pieces of equipment on top of the rope.

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Latest News About New Tools, Techniques and Services

140,000 LB. BLOWS FOR 36 HOURS

Rugged McCullough Double Acting Rotary Jars Still in Perfect Condition After Recovering Fish

Field Report on this Amazing Job:

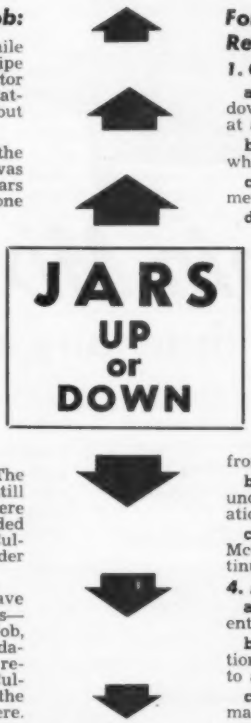
It was an isolated location in Canada. While drilling at 1450' with a 9" rock bit, the drill pipe became stuck in a spiral key seat. The contractor tried to free the pipe by working and circulating, at times pulling as much as 310,000 lbs., but the pipe remained stuck.

The McCullough Magna-Tector located the stuck point and the McCullough String Shot was used to back off the drill pipe. Five drill collars and the drill pipe were recovered, leaving one drill collar and the 9" rock bit in the hole.

The contractor screwed back into the drill collar with a McCullough Safety Joint and a 4½" McCullough Double Acting Rotary Jar, with eleven drill collars above the rotary jar. After jarring continuously for 12 hours, striking blows 140,000 lbs. above the weight of the drill string, it was thought advisable to recover the drill collar and bit by washover operations. However, 7⅝" wash pipe was not available in the area so jarring was continued. After 36 hours, continuously striking 140,000 lb. blows, the fish was recovered.

Two cones were completely sheared from the rock bit and one was bent in. The McCullough Double Acting Rotary Jar was still in excellent condition. The striking surfaces were not overly worn and the packing still provided a perfect seal. Had it been necessary, the McCullough Rotary Jar could have continued under this severe usage for many more hours.

McCullough Double Acting Rotary Jars have been used on hundreds of jobs as severe as this—some a great deal tougher. But, whatever the job, the operator can be sure of one thing—dependability. And this dependability—consistently repeated for more than 20 years, has earned McCullough Rotary Jars the reputation of being the standard of reliability in oil fields everywhere.



For 20 Years the Standard of Reliability Because:

1. CONTROLLED POWER

a. The force and direction of the blow (up or down) is under complete control of the operator at all times.

b. McCullough Rotary Jars strike blows **only** when desired.

c. Blows struck are solid, uniform, metal-to-metal every time.

d. Heavy sections of solid steel give striking surfaces and releasing teeth strength and durability far beyond that of any jarring tool.

2. SIMPLICITY

a. McCullough Double Acting Rotary Jars consist of only two major parts and the packing—no complicated mechanism to fail, no joints to come unscrewed.

b. The need of a bumper sub is eliminated—McCullough Rotary Jars do all the work.

3. DEPENDABILITY

a. Open construction prevents the jars from sanding up or freezing.

b. McCullough Rotary Jars will stay packed under high pressure drilling and testing operations.

c. Rugged strength and dependability make McCullough Rotary Jars most practical for continuous use in the drill string.

4. ADAPTABILITY

a. McCullough Rotary Jars have been consistently used with all makes of testers.

b. Complete control of jarring action, mentioned previously, means complete adaptability to any jarring operation.

c. Extra large diameter circulation hole with many obvious benefits.

WRITE FOR TECHNICAL BULLETIN #501 for complete description of the McCullough Double Acting Rotary Jar, illustrations, specifications, and many more actual job reports—actual jobs that may help you save hours of rig time the next time you need rotary jars.

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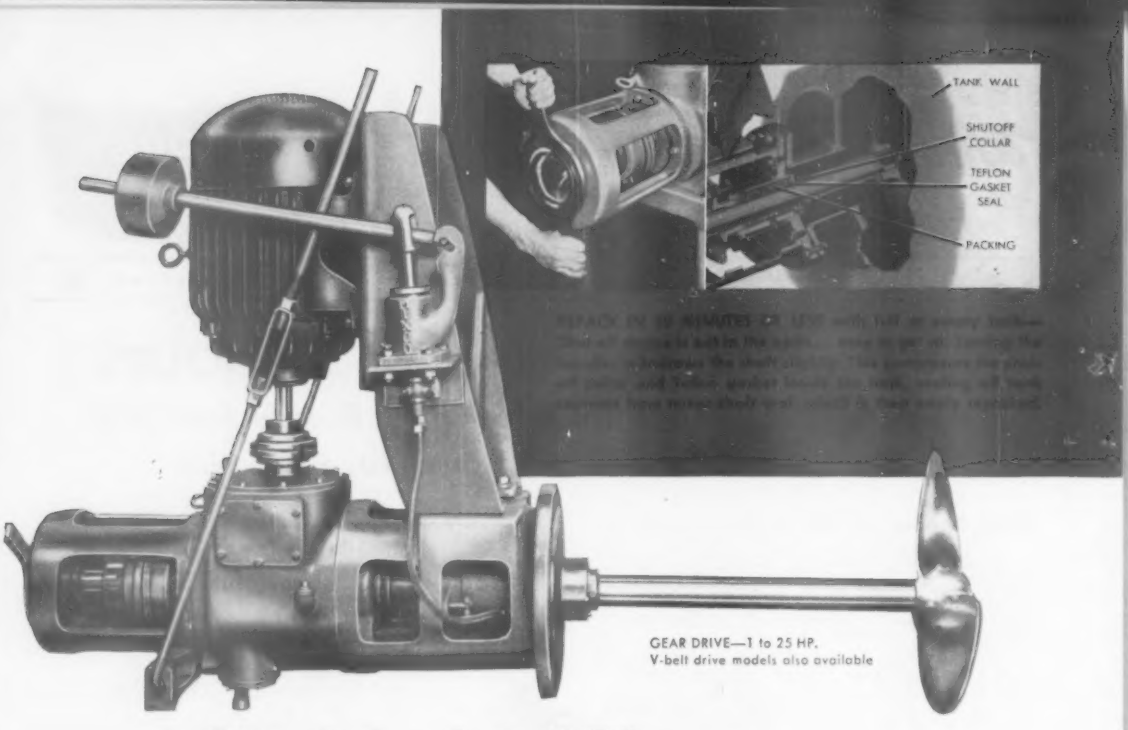

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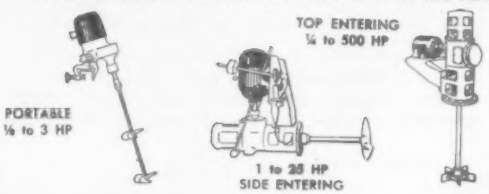

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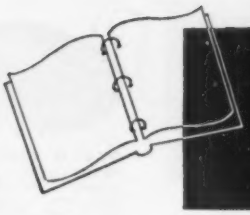


REFINER'S NOTEBOOK

ELECTRICAL INSTALLATIONS—10

Fused Equipment

by B. Z. Segall*

THE code indicates that approved explosionproof enclosures for fuses may be installed in Class I, Division 1 and Division 2 locations. No industrial control equipment, switches, panel boards, or any type of fused equipment is listed for use in Class I locations.

For Class I, Division 2 locations, fuses (this will also apply to circuit-breaker equipment) may be installed in general-purpose enclosures if the following limitations are applied to the installation:

1. Ten sets of fuses or less (or circuit breakers) are installed in any one room, area, or section. A set of fuses (or circuit breakers) shall contain as many fuses (or single-pole circuit breakers) as are necessary for a single protective function in a circuit, i.e., it may consist of one or more fuses (or one or more single-pole circuit breaker).

2. The fuses (or circuit breaker) will not be used as switches to interrupt current. It is presupposed that other switches (or circuit breakers) will be installed for this purpose in nonhazardous areas, and that these units will serve for overcurrent protection only.

3. The fuses (or circuit breakers) will be installed only for protection of lighting feeders or lighting branch circuits.

4. The lighting fixtures on these circuits or feeders will be in fixed position, i.e., not portable units.

This is permitted for construction in Division 2 locations since these areas are classified on the predication that flammable atmospheres will be present only under abnormal conditions, i.e., accidental breakdowns, etc. These fuses (or circuit breakers) are installed solely for the purpose of overcurrent protection and not for switching. To have an explosion, two things must occur simultaneously: (1) the system must break down and cause a flammable gas or vapor to exist, and (2) the electrical system must become overloaded or "short out," causing the fuse to blow (or the circuit breaker to trip).

A simultaneous occurrence of these two conditions is most unlikely.

Motors and generators . . . In general, all motors, generators, and similar rotating electrical machinery must be enclosed in explosionproof casings, approved for Class I locations. For Division 2 locations, standard squirrel-cage motors and similar electrical machinery, which do not employ sliding contacts, centrifugal devices, or other switching mechanisms, brushes, etc., may be installed.

In Division 2 location any of the electrical rotating machinery having such contact devices, switches, brushes, etc., must be either (1) explosionproof approved for Class I locations, or (2) provided with explosionproof enclosures approved for Class I locations for these devices.

*Consulting engineer, New Orleans.

Petroleum Products . . .

a new reference page.

This new feature starts with the issue of January 5, 1953. This page will appear intermittently as a feature of the Refiner's Notebook.

The discussions will cover fuels and lubricants and other products specifications, tests, research . . . with comment on specification changes and trends and classified reference list.

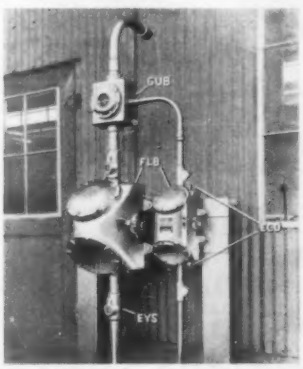


Fig. 1—Installation of Class 1 starter and controller.

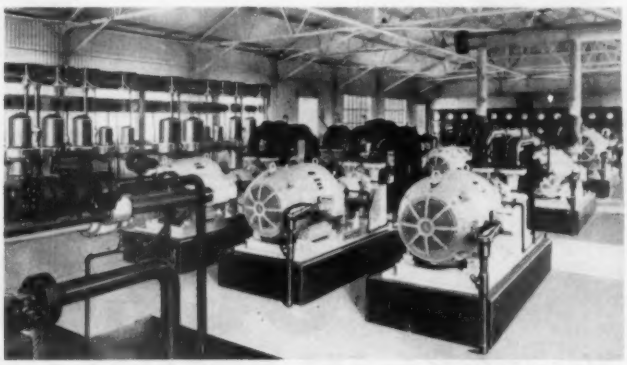
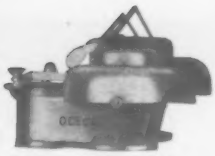


Fig. 2—Typical Class 1 hazardous location installation. (Crouse-Hinds Co.)

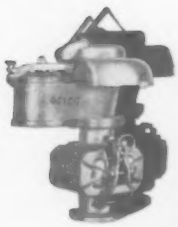


V-113 VENT VALVES control tank breathing, minimizing vapor losses and deterioration of product. High flow capacity. 2" to 12" sizes. ½ oz. to 8 oz. pressure or vacuum settings.

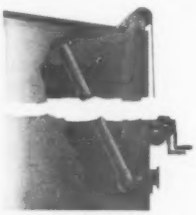
GAGE HATCHES provide a gas tight closure for gauging, sampling and taking temperature readings. Pedal type hatch opens with a natural straight downward foot movement. Flanged or screw mounting. Also clamping cover type for pressures from 2 oz. to 15 lbs.

OCECO ROOF MANHEADS provide a gas tight closure on the tank roof. White metal or composition sealing ring. Furnished in 20" size only.

V-108 EMERGENCY PRESSURE RELIEF VENTS provide instant relief for excessive internal pressures, resulting from exposure fires, etc. Furnished in 6", 8", 10", 15¼" and 20½" sizes.

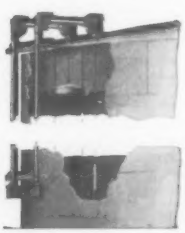


TYPE "BE" VENT UNITS consist of a V-113 Vent Valve with snuffer, mounted on a Type "E" "Extensible" Bank Flame Arrestor. 2" to 10" sizes. Unsurpassed for efficiency and reliability.



SWING LINE EQUIPMENT—complete facilities including heavy duty tank nozzle; efficient double elbow swing joint; swing pipe; cable clamp; cable; sheave bracket and internal or external winch.

TYPE "E" FLAME ARRESTORS can withstand long exposure to fire. The "banks" have vertical straight through passages—minimizing entrainment and pressure drop, and are "extensible" for easy cleaning. 2" to 10" sizes.



GAUGING EQUIPMENT—wide variety of types for roof or on the ground readings of cone, umbrella, floating, or expansion roof and spheroid tanks. Pressures ranging from 0 to 125 lbs. per sq. in.

V-114 INTERNAL TANK VALVES are provided with a fusible link that melts when subjected to fire, closing the valve instantly, and cutting off the flow. 3", 4", 6", 8", 10", 12" and 16" sizes.

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QUESTIONS ON TECHNOLOGY

by W. L. Nelson
Technical Editor

How Much Oil Equals A Ton of Coal?

How much Bunker C fuel oil is the equal of a ton of coal? I know of the heating values but what is the advantage of oil in firing?—M. H. O.

This question was treated on these pages, "Relative Cost of Coal or Oil Firing," July 12, 1951, page 106, continued July 19, 1951, page 114; and "Plant Comparison of Value of Coal and Oil," September 20, 1951, page 329. However, final conclusions were not presented because of a lack of detailed information.

Three major factors are involved: (1) heating value, (2) thermal efficiency in firing, and (3) cost of operation, involving power required, heat required, retirement of investment and maintenance of equipment:

1. Heating value . . . This relationship can be determined with more accuracy than the others. Bituminous coal ranges downward in heating value from about 13,800 B.t.u. per pound (at 4 per cent moisture and 5 per cent ash) to as low as 12,000 B.t.u. per pound for a coal that contains 13 per cent ash and 8 per cent moisture. A common heating value is 26,200,000 B.t.u. per ton although some Appalachian coal had dropped by 1951 to only 25,400,000 B.t.u. per ton because of increases in ash.

The heating value of a barrel of fuel oil ranges from about 6,260,000 to 6,450,000 B.t.u. and 6,360,000 B.t.u. is a good average value. On a plain heating value basis the barrels of oil required to equal 1 ton of coal is:

$$\frac{26{,}200{,}000}{6{,}360{,}000} = 4.12$$

2. Thermal efficiency . . . Fuel oil can be fired more effectively than coal. In large power-plant installations the difference is not great, perhaps not over 1 per cent. In most operations, however, oil firing is more efficient by about 3 per cent (75 per cent in coal firing and 78 per cent in firing oil). Some literature references indicate differences in efficiency of even 10-15 per cent in favor of oil.

3. Cost of operations . . . Coal installations that are completely mechanized can be operated at a cost that is only about 16 cents greater than the cost of firing oil. In very small plants or in plants that handle the coal by shovel, the cost of operating a coal plant is very much higher. In coal plants the car of coal must be thawed if the prevailing temperature is low, the car must be shaken to save the coal dust, the coal must be conveyed to an elevator, stored in bunkers or silos, and conveyed to the firing hoppers either by a monorail hoist, lift trucks, or by a conveyor system. The ash must also be removed. The stokers or pulverizers used in coal firing are very expensive as compared with oil burners, but since both types of equipment are installed in large power plants, no credit was given to oil for the cheapness of oil burners.

Somewhat more expensive storage facilities are required for oil, and it is necessary to heat the oil, pump it past the burners and atomize it either with steam or by mechanical means. Consideration of all of these leads to a greater cost in coal firing of about 16½ cents per ton.

Stated mathematically, the three factors are related as follows:

$$O = \frac{(E_o/E_c)\,C}{H_c/H_o} + \frac{0.165x}{H_c/H_o}$$

or if the average factors or values mentioned above are inserted:

$$O = C/4 + 0.04x$$

in which:

- O = parity price of delivered oil, $/bbl.
- C = cost of delivered coal, $/ton.
- E_o and E_c = thermal efficiency of firing for oil and coal.
- H_o and H_c = heating value of oil and of coal.
- x = ratio of operating costs—the year under consideration divided by the cost in 1951 (the Nelson Refinery Construction Index of The Oil and Gas Journal is satisfactory).

As one illustration, if coal is being delivered for $10.00 per ton, the price that can be paid for residual fuel oil is:

$$\frac{10.00}{4} + 0.04\,\frac{162}{157.2} = \$2.541$$

Effect of Sulfur in Fuel Oils

"What is the effect of sulfur in fuel oils?"—M. G. R.

Sulfur is not ordinarily considered as significant in fuel oils unless the oils are to be used for metallurgical purposes. However, in the operation of economizers in boiler plants, a condition of corrosion or fouling tends to occur if the flue gases are cooled to low temperatures and sulfur content appears to be an important factor in the degree of fouling and corrosion. Table 1 indicates the effect of sulfur in various fuels (Bulletin 3-407, Babcock & Wilcox Co., W. H. Rowand, "Recent Boiler Design Practice").

TABLE 1—MINIMUM METAL TEMPERATURES† IN TUBULAR AIR HEATERS OR ECONOMIZERS* AS A FUNCTION OF SULFUR CONTENT OF FUEL

Per cent sulfur in fuel	Bituminous chain grate underfeed stoker	Oil	Bituminous spreader stoker	Pulverized fuel
1.0	*180	*180	*160	*160
1.4	*180	*180	*160	*160
1.72	*180	*180	*168	*160
2.1	212	*192	*175	*160
3.0	239	222	*193	*176
4.0	259	244	210	*193
5.0	276	258	224	*206
6.0	290	270	235	217

*Minimum of 212° F. in economizers. †Really feed-water inlet temperature in economizers.

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Among the Drilling Contractors

Eight Rotary Rigs Running In New East Payson Field

Eight rotary rigs, representing five contractors, now are working in the comparatively new East Payson field, southern Lincoln County, making this one of the most active spots in central Oklahoma.

Vierson & Cochran, Inc., Okmulgee, Okla., leads the contractors with four rigs running, three for Gulf Oil Corp. and one for its own account. Other contractors, each with one rig, and their respective operating companies, are: Robinson & Marshall Drilling Co., Shawnee, Okla., Gulf Oil Corp.; Berg & Buck Drilling Co., Shawnee, Powel Brisco; Kidd Williams Drilling Co., Tulsa, Midstates Oil Co.; and Falcon Seaboard Drilling Co., Tulsa, Sun Oil Co.

The field was opened last May by Gulf Oil Corp., using a Viersen & Cochran rig. Seventeen wells have been completed. Pay horizon is the lower Skinner sand, encountered at depths from 4,000 to 4,150 ft.

Keating Drilling Co., Tulsa and Fort Worth, has a rig running for Edwin L. Cox in the North Sandusky area of Grayson County. Current operation is 1 Moran. Projected depth is 8,300 ft. with rotary tools.

Dixie Drilling Co., Dallas, has operations under way on a 13,500-ft. wildcat test it has contracted to drill for Richardson & Bass at 1 Fidel-Federal, 15 miles east of Carlsbad, Eddy County, New Mexico.

Coffield & Guthrie, Corsicana, Tex., are drilling for Intex Oil Co. at a wildcat location a mile north of Eureka, in the William Bright Survey, Navarro County, East Central Texas. The well is designated as 1 Penney.

New Drilling Company

Stogner-Camp Drilling Co. is a newly organized rotary-drilling contracting firm operating in the tri-state area of Illinois, Indiana, and western Kentucky. Principal owners are A. P. Paul, trucking contractor in the area, and R. L. Camp, formerly field superintendent for Basin Drilling Co., Owensboro, Ky. Main office is in Henderson, Ky.

R. W. Bass Drilling Co., Kilgore, Tex., is under contract for a test to be drilled for Renwar Oil Corp. and Hemphill & Hosey at a wildcat location in the L. W. Ross Survey, 6 miles west of Old Boston, in Bowie County, northeastern Texas.

Penrod Drilling Co., Shreveport, is starting a projected 10,500-ft. Cotton Valley test for Southwest Gas Producing Co., Inc., of Monroe, La., in the new South Ruston area, southern Lincoln Parish, Louisiana. Location, in 10-17s-3w, is a little more than a mile south of the recently completed discov-

On location in the Yarborough-Allen field in southwestern Ector County, West Texas, where Helmerich & Payne, Inc., Tulsa, is drilling for Magnolia Petroleum Co. Front row, left to right: Dick Reeves, Bovaird Supply Co.; L. B. Parham, driller; E. B. McCarty, crew member; E. Mel Allday and R. M. Weaver, W. D. Filter & Supply Co., Odessa; Cecil Campbell, tool pusher. Rear, same order: Drew White, James Moore, and A. J. Yeargain, crew members.

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ery well, producing from the Travis Peak. The test is designated as 1 Sherrad.

Great Western Drilling Co., Lubbock, Tex., has a contract with Texas Pacific Coal & Oil Co. for a 13,500-ft. wildcat test to be drilled 6 miles west of the South Saunders field, in Eddy County, New Mexico. The new operation is 1 Lane-Mill unit. Location is in 32-15s-32e.

Don Johnston Drilling Co., Oklahoma City, is starting a 4,800-ft. Bartlesville test 3 miles south of Wellston, Lincoln County, Oklahoma. Contract is for Kingwood Oil Co. Location is at 1 O'Keefe, NW NW SE 34-14n-2e, 2½ miles northwest of the West Happy Hill pool.

Tripledee Drilling Co., Ardmore, Okla., is drilling for Falcon Seaboard Drilling Co., of Tulsa, at a wildcat location 1½ miles northwest of McMan, Jefferson County, southern Oklahoma. Location is for 1 Lawrence, NW SW SE 11-4s-4w.

Ace Drilling Co., Wichita Falls, Tex., has a rig under contract to T. D. Humphrey for a wildcat test, 1 Rosie George, in the J. C. Jacobs Survey, 4 miles southeast of Kemp, in Kaufman County, East Texas.

Warren & Bradshaw Exploration Co., Tulsa, is drilling for The Texas Co. at a wildcat location 5½ miles east of Marietta, in eastern Love County, southern Oklahoma. The test is 1 Conrad, in the SW SE NW 17-7s-3e.

Gibson Drilling Co., Los Angeles, is drilling for Atlas Oil Co. at an extension location southeast of the Rosedale field, Kern County, California. Location is in 19-29s-27e. Projected depth is 7,500 ft.

ACTIVE ROTARY RIGS*
(United States and Western Canada)

Area—	Week ended 12-15-52	Change week ended 12-8-52	Change week ended 12-17-51
Gulf Coast	625	−17	− 16
N. & W. Tex.-N. M.	879	+31	−174
Ark.-N. La.-E. Tex.	146	+ 4	− 51
Oklahoma	373	+18	− 6
Kansas-S. Nebraska	204	+27	− 7
Illinois-Eastern	138	−10	+ 4
Rocky Mountains	237	+14	+ 43
Pacific Coast	179	+ 4	− 6
Total U. S.	2,781	+71	−213
Western Canada	181	+ 6	+ 10
Total	2,962	+77	−203

*Courtesy Hughes Tool Co. Trends in drilling activity in the United States and the Gulf Coast and Arkansas-North Louisiana-East Texas areas are shown on pages 392 and 393.

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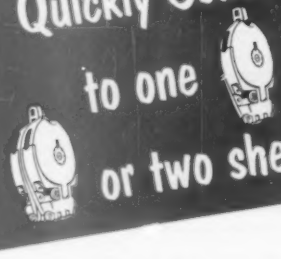
New!

Baash-Ross "PB" Quick Change PRODUCTION BLOCK

Quickly Convertible to one or two sheaves!



Baash-Ross—pioneers of modern unitized Block-and-Hook designs and many other important Block advancements—now brings you *another* vital development in this field . . .

A Block (with choice of connector units) that can be quickly converted to one sheave or two sheaves, depending upon requirements—*without re-reeving the lines or making complicated changes!*

Use it as a *two*-sheave Block when pulling tubing and doing other work where the added capacity of a four-line string-up is needed.

Then, by simply removing a few bolts, the Block can be divided, one sheave anchored in a corner of the rig without even re-reeving the lines (see left, below) and you have a fast-acting *single* sheave Block for pulling rods and other light work where fast Block travel is desired.

As a *single*-sheave unit the Baash-Ross "PB" has more weight than conventional single-sheave blocks—falls faster, hangs straight, doesn't "wander" when running empty.

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What about line reeving?

Baash-Ross has simplified that, too. Each sheave unit can be easily opened to expose the sheave without removing covers, as shown at right. Lines are simply *laid* in place—can be left looped in rig between jobs to save time and eliminate dangerous crown reeving each time a job is set up.

Wide choice of Connector units

To increase still further the unusual adaptability of Baash-Ross "PB" Blocks, they can be equipped with any of a wide choice of Connector units . . . Becket—spring-loaded Link Adapter—spring-loaded Standard Hook—or spring-loaded Oversize Hook. Both the Hooks and Link Adapter are free-swiveling in a full 360° circle, or can be quickly locked in any of 8 equi-spaced positions.

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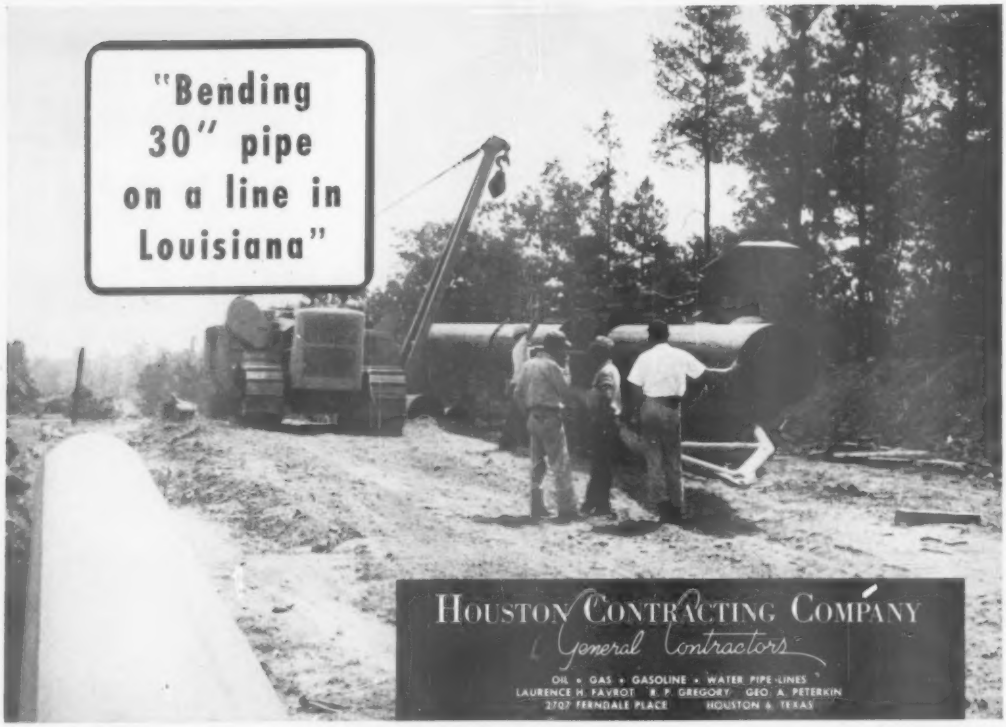
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PIPE LINES

Completion Near

Giant West Texas crude line to begin operation

HOUSTON.—The largest crude line on the continent, West Texas Gulf Pipe Line Co.'s 26 and 20-in. carrier from Colorado City to Sour Lake, Tex., in the Houston refining area, will begin initial operation the first of January.

A spokesman for Gulf Refining Co., builder and operator of the line for itself and four other companies, said last week that all sections of the 466-mile trunk and its 112-mile branch to Longview have been completed and tested except for the 37-mile segment of 26-in. from Saratoga to Nederland. Work is well along on this last section.

Work on the pump stations, which for a time was running behind schedule, now has caught up and will be completed about the same time as the pipe laying.

Initial capacity of the big line is 300,000 bbl. daily. It is expected to reduce transportation costs as well as increasing the mobility of West Texas crude.

Line idled . . . Gulf Refining, the spokesman said, will shut down part of its existing line to the coast when the new trunk line is placed in operation. The northern section of the line will continue to carry crude to Midland where it will be delivered to the West Texas Gulf line at Colorado City through Gulf's new Mesa pipe line. A portion of the remainder of the 130,000-bbl. line to southern New Mexico may be converted in the future to handle L.P.G. The rest will be taken up.

Tariffs for the West Texas Gulf line probably will not be filed with the Interstate Commerce Commission and the Texas Railroad Commission until after the first of the year, the Gulf official said.

Tuscarora Completes New Pittsburgh Products Branch

PITTSBURGH.—Tuscarora Oil Co. last week officially opened the Pittsburgh branch of its trans-Pennsylvania products pipe line.

Operation of the 6-in. spur represents one of the final steps in the completion of Tuscarora's $10,000,000 modernization program for its 350-mile system running from Linden, N. J., to Midland, Pa.

The new spur has a capacity in ex-

Pipe Lines and Conservation

One of the pipe-line companies' most-vital and least-publicized jobs is that of leaving the land of a farmer or other owner the way it was before the pipe line went through. In the case of Texas Gas Transmission Corp., soil-conservation experts are employed to follow the pipe gangs. After construction is completed on this section of Texas Gas' 408 miles of 26-in. looping between Bastrop, La., and Jeffersontown, Ky., conservation men will set to work on the right-of-way, seeding the ground with vegetation for protection from erosion, or planting the crop that the farmer prefers. Wherever hilly terrain makes it necessary, the ground above the pipe line will be terraced to prevent erosion.

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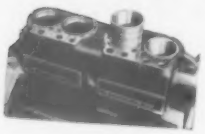
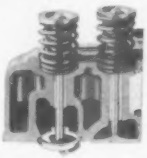
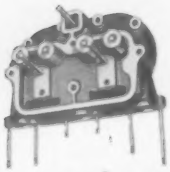


Valve-in-Head construction



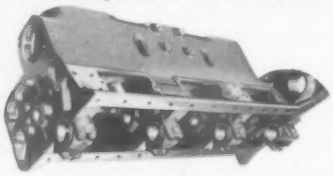
and on the larger size engines one Interchangeable



Head to each two cylinders. Permits one

man to make repairs at the location.

Heavy



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cess of 7,100 bbl. daily and is designed to permit doubling of capacity when necessary. It connects with the company's main line north of Pittsburgh. It will increase products available to the Pittsburgh area and will replace barge shipments from Midland with an all-weather delivery system.

Completion of the entire modernization program is scheduled for next spring. The system then will have an initial capacity of 42,000 bbl. daily, which can be increased to 85,000 bbl.

Rancho Firms Advised to Defer Crude Arrangements

HOUSTON.—Whether the big Rancho crude line from McCamey, West Texas, to the Houston area can be completed as planned by mid-February is dependent on the weather, D. H. Lewis, president of Shell Pipe Line Corp., builder, operator, and part owner, said last week.

Up to December 5, about 63 per cent or 286 miles of the 455-mile, 24-in. trunk line had been laid by two spreading crews employed by Anderson Bros. Corp. and Houston Contracting Co. Anderson Bros. has contract for the 267-mile western segment of the line, while Houston is laying the eastern 188 miles. Work on the latter section was slowed recently by heavy rains.

Companies planning to use the system, Lewis said, have been advised to make their crude arrangements effective March 1 to avoid transportation headaches in case the line is not completed by the middle of February.

Rancho is owned by Shell, Sinclair Pipe Line Co., Phillips Pipe Line Co., Ashland Pipe Line Co., Crown Central Petroleum Corp., Pan American Pipe Line Corp., and Nantucket Pipe Line Co., a subsidiary of Eastern States Petroleum Corp.

Pan Am Spending $4,425,000 On Connections With Rancho

HOUSTON. — Pan American Pipe Line Co. has let $4,425,000 in construction contracts to connect its facilities with those of the nearly completed Rancho crude line owned by Pan Am and six other companies.

The $35,000,000 Rancho line is scheduled to begin carrying crude from McCamey, West Texas, to the Houston area early next year.

Contract for construction of about 43 miles of 16-in. from the terminus of Pan Am's 10-in. Scurry County line near Arden to a point near the Bailey pumping station of the Rancho line near Eldorado has been let to Vaughn

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& Taylor Construction Co., Inc., Wichita Falls. Pipe is already on hand and will be in the ground by the end of January.

Station Construction Co., Austin, is now at work building a pump station, named the Concho station, near Rancho's Bailey station to transfer crude into the Rancho line. The firm also is under way on the construction of a 375,000-bbl. tank farm nearby. Completion of both projects is set for the end of January.

Pan Am also is laying 28 miles of 26-in. from the eastern end of the Rancho line near Houston to its refinery at Texas City and is modernizing its tank farm there. Pipe-line work will be done by Brown & Root, Houston, Inc., while the tank-farm contract has been let to Farnsworth & Chambers Co., Inc., Houston.

The tie-in with the Scurry line, the new pump station, and the new tank farm are estimated to cost about $2,275,000, while the eastern line and tank-farm work will cost about $2,150,000.

Pan Am reportedly is the only owner of Rancho carrying out major construction to connect with the trunk, which runs close to the lines of the other participating firms.

Hearing Near on Ohio Fuel's Storage-Expansion Program

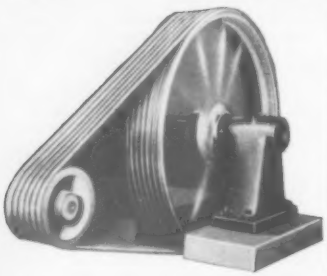
WASHINGTON.—A Federal Power Commission hearing is scheduled to begin here January 6 on two applications by Ohio Fuel Gas Co., Columbus, for authority to construct pipe-line facilities required for its underground-storage expansion in Ohio.

Cost of the program is estimated to exceed $6,550,000. In one of the applications Ohio Fuel proposes to expand its underground-storage capacity by converting six producing pools in north-central Ohio to gas-storage service. Total estimated cost of this construction is estimated at $4,880,000.

Under the second application, the company would lay additional pipe lines to increase the capacity of its system dedicated to carrying gas to and from storage. Cost of this construction is estimated at $1,675,000.

Ohio Fuel's current total underground-storage capacity is about 100 billion cubic feet in five former gas-producing reservoirs in central Ohio. The planned expansion reportedly would raise this to about 115 billion cubic feet and involve the addition of 100 or more facility wells to supplement the approximate 625 wells in operation through out the company's storage system. Ohio Fuel is an affiliate company of Columbia Gas System, Inc.

Wood's V-BELT DRIVES



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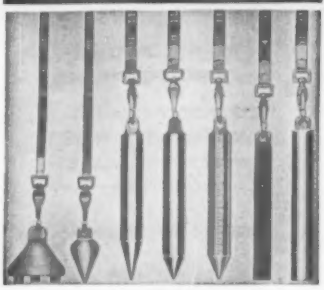

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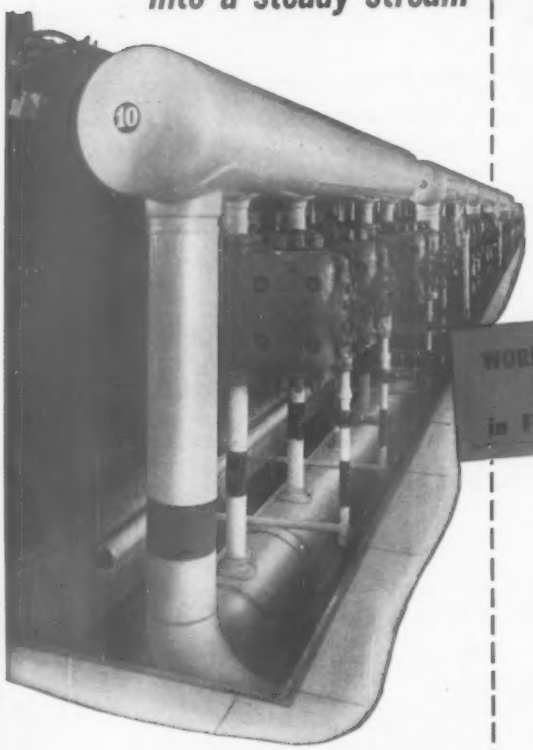

How do you reduce the throbbing in your plant piping—with oversized piping and heavier wall thicknesses? With reinforced structure supports and mechanical vibration dampeners? How accurately are you metering gas?

Fluor Pulsation Dampeners work at the cause of the trouble. Their unique design principle smooths out pulsations to the extent of at least 85%. This means that damage to piping, coolers, heat exchangers, processing equipment and even buildings will be eliminated. It means reduced maintenance, more accurate gas metering and smoother, safer, more efficient plant operation.

Fluor Pulsation Dampeners are used on any type gas stream—air, steam, hydrocarbons—at operating pressures ranging from vacuum to 5,000 psi. Dimensions can be tailored to fit space limitations. Units may be installed on the suction and/or discharge lines and are sufficiently flexible to meet minimum pressure drop requirements.

WORKMANSHIP and PERFORMANCE are guaranteed in FLUOR PULSATION DAMPENERS

Performance and workmanship are guaranteed in every instance where a Fundamental Pulsation Dampener or Pulsation Dampening System is installed. Here are excerpts from the guarantee:

"The Fluor Corporation, Ltd., guarantees that the pulsation dampeners or pulsation dampening systems . . . conform to all specific code requirements, and the workmanship is in accordance with standard shop practice by qualified welders."

". . . that the equipment will satisfactorily correct conditions of piping vibrations which are due to excessive pulse pressure in the piping system, or correct inaccurate gas metering caused by pulsative flow . . ."

". . . that the dampeners or pulsation dampening systems will decrease the magnitude of the pulse pressure in the compressor plant header piping to a value not to exceed 1.25 percent of the compressor operating pressure. The above percentage reduction applies to both suction and discharge pulsation dampeners or dampening systems . . ."

". . . that the pulse pressure in the plant header piping will not exceed the pulse pressure which is measured in the lateral between the volume bottle and the suction or discharge header, respectively."

". . . that the total pressure loss through the pulsation dampeners or pulsation dampening systems, measured by means of a differential pressure indicator and expressed in pounds per square inch, will not exceed the value set forth on the attached Dimensional Outline Sheet or layout drawing . . ."

Contact your nearest Fluor representative for the answer to your specific pulsative flow problems. Following preliminary study, he will be pleased to recommend the Fluor Pulsation Dampener that best fits your particular requirements. Or, write The Fluor Corporation, Ltd., Los Angeles 22, California.

Two Fluor "Package Type" Models

Fluor Pulsation Dampeners are available in two models: the Fundamental and the Higher Frequency. The Fundamental is recommended for installation in all compressor piping systems where excessive vibration is caused by peak pulse pressures at the fundamental frequency. The Higher Frequency Pulsation Dampener is recommended where frequencies are encountered above the fundamental (second harmonics or higher frequencies).

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Designed primarily for new construction, Fluor Pulsation Dampening Piping Systems are furnished in prefabricated form, ready for installation. Systems are designed for any type gaseous stream at operating pressures ranging from vacuum to 5,000 psi. Advantages include: improved flow measurement, fewer maintenance requirements, protection of related equipment, and smooth operation of plants and stations at rated capacity. Write for Bulletin PDS-8501.

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REFINING

Kanotex Sold

Control of Kansas company goes to Anderson-Prichard

OKLAHOMA CITY, Okla.—Anderson-Prichard Oil Corp. revealed last week it has purchased a controlling interest in Kanotex Refining Co., Arkansas City, Kans.

Kanotex, a Kansas corporation, has a 13,000-bbl. refinery at Arkansas City, where it completed and placed on stream a new cat cracker September 1 of this year. The refinery has connections with the products lines of Great Lakes Pipe Line Co. Kanotex has access to crude supplies in Kansas, Oklahoma, and West Texas. Its production is about 400 bbl. daily.

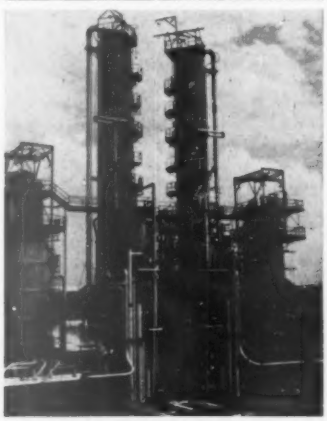
Expansion planned . . . Roland V. Rodman, president of Anderson-Prichard, said the new owner will begin immediately to increase the refinery's capacity to 15,000 bbl. daily. Capacity eventually will be increased to 20,000 bbl. daily, Rodman said.

The company currently is marketing products from two refineries—Anderson-Prichard's 10,000-bbl. plant at Cyril, Okla., and Col-Tex Refining Co.'s 8,745-bbl. installation at Colorado City, Tex. Thermal operations at the two plants total 8,500 bbl.

Anderson-Prichard, a Delaware corporation, markets in the Midwest and North Central states. Stock is publicly owned and listed on the New York stock exchange.

Rodman said Anderson-Prichard's acquisition of the refinery was the result of many months of searching for a plant situated well enough to aid the company materially in its refining facilities-expansion program.

Operations of Kanotex will be carried on by its present employes except that C. M. Boggs, president and general manager, R. R. Cox, treasurer, and W. L. Lesh, vice president and sales manager, will retire at the end of this year.



Expansion at Cleveland

New crude topping and vacuum distillation facilities at the No. 1 Cleveland refinery of Standard Oil Co. of Ohio comprise twin two-stage crude units pictured above. Each unit consists essentially of a desalter, a crude tower with side-stream stripper, a naphtha-splitter tower, and a vacuum tower A depropanizer tower and gas-compression facilities are common to both units. Joint design capacity of the twin units is 45,000 bbl. per stream day. Throughput is somewhat higer and finally will reach 50,000 bbl. per day.

Gulf Completes New Sulfur Unit at Port Arthur, Tex.

PORT ARTHUR. — Gulf Refining Co. has begun operations on a new sulfur-recovery unit at its 200,000-bbl. refinery here.

The new unit is capable of converting more than 90 per cent of the hydrogen sulfide present in the refinery's off gas, to make 61 long tons per day of 99 per cent pure elemental sulfur.

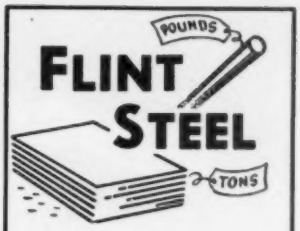
The sulfur is being moved in liquid form to an acid plant in the refinery, where it is converted to sulfuric acid. The acid in turn is consumed in Gulf's alkylation plant, providing sufficient catalyst for the manufacture of 720,000 gal. daily of 100-plus aviation gasoline.

The new sulfur-recovery unit is designed to permit future expansion of 100 per cent and has eliminated the necessity of purchasing outside sulfur for the acid program at Port Arthur. Construction was begun last June by the Ralph M. Parsons Co. of Los Angeles. A certificate of necessity, granted previously, lists the project as costing $586,390, of which 80 per cent was approved for accelerated amortization.

Union Completes 38,500-Bbl. Vacuum Unit at Wilmington

LOS ANGELES.—With the completion last week of a new 38,500-bbl. vacuum-distillation unit, Union Oil Co. is one step nearer completion of the $27,000,000 expansion program at its Wilmington refinery.

The new unit will supply feed stocks



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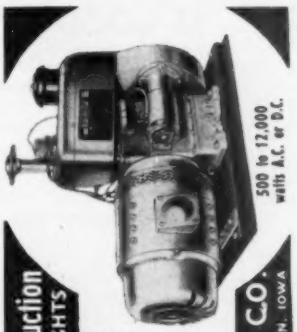

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YE GOOD KING WENCESLAUS
by YE GOOD SAINT "VIC"

Sad King Wenceslaus looked out
At the royal piping,
Faulty lines lay all about
(Those leaks and breaks were griping!)
Then he saw with much delight
What was in his stocking,
He found Couplings sure leak-tight
(Victaulics famed for locking!)

"Ah! Victaulic Fittings, too,"
Roared the King now smiling,
"Elbows, Tees all grooved and true,"
(And Full-Flow in their styling!)
Good Saint "Vic" was in the know,
Vic-Groover tools were waiting,
Kingly smiles began to grow
(Their grooving's tops in rating!)

Zip! The King hooked up those sections,
Saint "Vic" did him rightly
With these very best connections
(No leaks and drips unsightly!)
For a Method that's complete
Wenceslaus is liking
Easiest way to make ends meet
(Victaulic's Four Star Piping!)

VICTAULIC COMPANY OF AMERICA
P. O. Box 509, Elizabeth, N. J. Office & Plant: 1100 Morris Ave., Union, N. J.

for a new 28,500-bbl. fluid catalytic cracking unit placed on stream last September.

A new 50-ton sulfur plant using waste refinery gases as charging stock also has been placed on stream at Wilmington. Early next year a 50-ton ammonium sulfate plant will be completed.

Ethyl Ready to Market New Diesel-Fuel Improver

NEW YORK.—Ethyl Corp. has announced that it is preparing to offer commercial quantities of its new "DB-36" diesel-fuel ignition improver.

The additive, which raises the cetane number of diesel fuel, consists of a mixture of primary amyl nitrates and is the result of more than 5 years of research and development work.

The U. S. Navy recently completed a 1-year testing program on the new additive and has approved its use in specification diesel fuel supplied for surface and underwater craft. Shipments will be available in tank car and 55-gal. drum quantities from points on both the East and West Coasts. Ethyl states that the blending operation is simple and inexpensive and requires no unusual safety precautions. Blending can be done at refineries or storage terminals.

Extensive highway and railroad service tests of the new cetane improver have been under way for some time, according to Ethyl.

Army Officers Training At Tide Water Refinery

BAYONNE, N. J.—As part of a 10-week industry-training program, officers of the U. S. Army Quartermaster Petroleum School have been assigned to Tide Water Associated Oil Co.'s refinery here for final instruction in their "Petroleum Analysis and Control Course."

The course includes instruction in refining operations, product research, marketing, marine and rail transportation, and management and administration. To date 11 Army officers have received training from Tide Water.

Humble Gets Safety Award

HOUSTON. — The National Safety Council has presented its award of honor to employes of Humble Oil & Refining Co.'s Baytown, Tex., refinery for chalking up the top safety record in 1951 among the refining divisions in the United States with an accident-frequency rate of 1.4 disabling injuries for each million man-hours worked. This compares with an industry-wide average of 7.17 disabling injuries.

NATURAL GAS

Gas Rule Delayed

Dissension develops over Texas proration proposal

AUSTIN.—The Texas Railroad Commission may drop its attempt to obtain approval of a new state-wide proration rule for natural-gas production.

Any action toward writing a new rule appeared to be in for a delay, at least, at the conclusion of a hearing on the subject here December 9-10 *(The Oil and Gas Journal, December 8, page 151)*.

The commission's proposal involved basing Texas field allowables on reasonable market demand. Production would be allocated to individual wells on the basis of 160-acre proration units under a two-thirds acreage, one-third well formula, instead of limiting allowables to 25 per cent of potential as has been the policy for the last 25 years.

Size at issue . . . Size of the units appeared to be the biggest issue at the hearing. Humble Oil & Refining Co. submitted a plan which would amend the proposal to call for 640-acre units with allocation based 100 per cent on acreage. Tide Water Associated Oil Co. suggested 320-acre units based on a 75-25 per cent formula but indicated it would go along with the Humble plan graduating allowables according to well depth and acreage up to a maximum of 6,510 M.c.f. daily for 11,000-12,000 ft. wells on 640-acre tracts.

Authority questioned . . . Authority of the commission to write a state-wide gas rule was challenged by C. C. Small, Sr., Austin attorney. Small said the commission can prorate gas production legally only to prevent waste or to protect property rights. W. W. Leewright, Corpus Christi, suggested that the commission seek an opinion from the attorney general to determine if it has the authority to write the rule.

J. A. Hall, head of the commission's gas division, said the hearing may be reopened a second time to take more testimony. Importance of the proposed change is apparent, Hall said, when one considers that between 600 and 700 of the state's approximately 1,200 gas fields now are producing without field rules which take precedence over state-wide regulation. Hence they would be affected by a change in the rules. These fields, he said, account for about a quarter of the nation's gas supply.

A request was made by the Texas Independent Producers and Royalty Owners Association that the commission not rule on the matter for 60 to 90 days in order to allow the organization and associated groups more time to study the proposed new rule.

FPC Reasoning Faulty in Phillips Case, Court Told

WASHINGTON.—The Federal Power Commission was accused last week by William E. Torkelson counsel for the Wisconsin Public Service Commission, of faulty reasoning in its ruling that it lacks power to regulate natural-gas operations of Phillips Petroleum Co.

FCP should have ruled, Torkelson told the Circuit Court of Appeals here, that Phillips is engaged in the transportation of natural gas for sale in interstate commerce and therefore subject to regulation by the commission.

He said Phillips goes beyond producing and gathering gas and actually carries it before making sales to five interstate pipe-line companies.

In addition to Wisconsin, the cities of Kansas City, Detroit, and Milwaukee are appealing to the court to reverse the commission's decision. All of these areas receive part of their gas supplies indirectly from Phillips.

Panhandle Gas Price Up

AUSTIN. — The average price of sweet natural gas at the well head in Panhandle field, Texas, is 6.9372 cents per M.c.f. at a pressure base of 16.4 psi., the Texas Railroad Commission reported last week.

This is about 10 per cent above the 6.3009 cents per M.c.f. reported in May 1951. Gas purchased at 14.65 psi. increased in value from 5.1628 to 6.197 cents per M.c.f.

Texas Collects $1,111,510 From October Gathering Tax

AUSTIN. — October revenue from Texas' court-contested natural-gas gathering tax is reported by Robert S. Calvert, state comptroller of public accounts, at $1,111,510.

The tax was paid by 187 firms, 137 of them paying under protest. Protested payments came to $1,007,331. The 49 companies not protesting paid $104,177. Nearly all of this sum, $97,-211, was paid by El Paso Natural Gas Co., the sole remaining major gas company going along with the tax.

Legality of the tax is being decided by an appeals court here after testimony by the contestants was completed earlier this month *(The Oil and Gas Journal, December 15, page 168)*.

Natural Gasoline

Sterling Oil Planning Two New Plants in Oklahoma

TULSA.—Sterling Oil of Oklahoma, Inc., Tulsa, has announced the impending construction by the company of two natural-gasoline plants in Oklahoma in East Spring Valley and East Edmond fields.

J. A. True, president of Sterling, said last week that plans are about completed for the East Spring Valley plant in Garfield County in the north-central part of the state. The East Edmond plant will be built later.

East Spring Valley field produces gas with an unusually high fluid content from Mississippi lime at 5,500 to 5,800 ft. Reserves from this formation, True said, are estimated at 175 billion cubic feet. Sterling owns about 3,750 acres on structure, he said, 1,000 acres of which have been developed.

East Edmond produces from the Bartlesville sand. True said the first development wells here made only slight gas volumes, but additional drilling in the western trend resulted in completion of high gas-oil ratio wells. Plans for the new plant in East Edmond, he said, await further development of this western trend.

New Kerr-McGee Plant in Texas Nearing Completion

OKLAHOMA CITY. — A. T. F. Seale, manager of the natural-gasoline department of Kerr-McGee Oil Industries here, said last week the company's new natural-gasoline plant in Moore County, Texas, will be ready for operation early next year.

The new plant will process 55,-000,000 cu. ft. of natural gas daily from fields either operated or owned and operated by Kerr-McGee in Moore and Sherman counties. It will produce 38,000 to 40,000 gal. daily of raw natural gasoline.

The $850,000 installation has been named Kerr-McGee Cactus Gasoline Plant No. 12. It is being built by Dresser Engineering Co.

Residue gas will be taken by Phillips Chemical Co.'s Cactus plant.

Wilson
MFG. CO.

Will Electrologs Yield Velocity Data?

THERE is a possibility that seismologists may now have a means to make every measurable electric log serve as an acceptable velocity survey.

One of the greatest problems confronting seismologists today is the need for a method of translating into feet the vertical travel time of shock waves measured in seismic surveying. This translation must be made if seismic mapping of the attitudes of subsurface rocks is to be sufficiently accurate to lead the way to tomorrow's oil fields.

The vertical velocity of shock waves in a section of rocks can be determined. However, current methods of velocity surveying are expensive and, in many cases, they do not give results of desired accuracy.

Because of the need for accurate velocity determinations and the inadequacies of current velocity-surveying methods, especially for a restricted portion of a rock section, at least four major companies have been developing bore-hole instruments that will give continuous velocity logs of a penetrated rock section. At least one of these companies has perfected its instrument to the point that it is ready to turn it over to some service company for commercial use. Information provided by these bore-hole velocity surveys will undoubtedly find many uses in oil exploration; however, the instruments do not solve entirely the need for developing a volume of velocity information.

At the last meeting of the Geophysical Society of Tulsa, L. Y. Faust, of Amerada Petroleum Corp., told of an investigation aimed at making velocity information more readily available.

Working from the basic concept that velocity is a function of depth, geologic time, and lithology, Faust had previously established a formula for velocity as a function of depth (measurable in feet) and geologic time (measurable in years) for an average sand-and-shale section, that is, for constant lithologic conditions. This was but an initial step in a study; and the formula, because unmeasurable lithology was not included, had no value whatsoever in predicting velocities in unknown rock sections. However, with the formula for two of the three variables affecting velocity established, Faust directed his recent investigation toward determining a measure of the remaining variable by use of electric logs.

Faust developed a formula from which velocities could be predicted in any given hole that had a measurable resistivity curve with an accuracy that indicated he may have established a law relating the three variables. Detailed work on the figures fed into this formula gave results that indicate the formula is sound. Though the accuracy of the predictions is still not within acceptable limits of error as compared to direct measurement, apparently the inaccuracies are due to variations in formation-water resistivity (the same problem that plagues quantitative interpreters of electric logs).

One factor of Faust's formula is the as yet unexplained relationship of resistivity and elasticity of rocks. Though it is not known why these two characteristics should have a relationship, in general, they do. Bore-hole velocity logs can be correlated with electric logs in most cases, but there is some evidence of discrepancy between the two which indicates the need for further evaluation. Explanations for these variations must be part of the effort to check on the ultimate value of Faust's formula.

Additional checks on the formula will require a volume of work too great for one man. Faust has called on other investigators to study his work and if they deem it worth more consideration to give him the necessary help to refine it. A more accurate scale on electric logs, especially where resistivity is low, would definitely aid future investigations.

Whether or not Faust has come up with a solution to one of the seismologist's big problems remains to be seen, but it is the concensus of most geophysicists who have heard his paper that he is on the right track and future work deserves the cooperation of other velocity investigators.

Philip C. Ingalls.

Faust's paper, "A Velocity Function Including Lithologic Variation" will be published in the April 1953 issue of Geophysics."

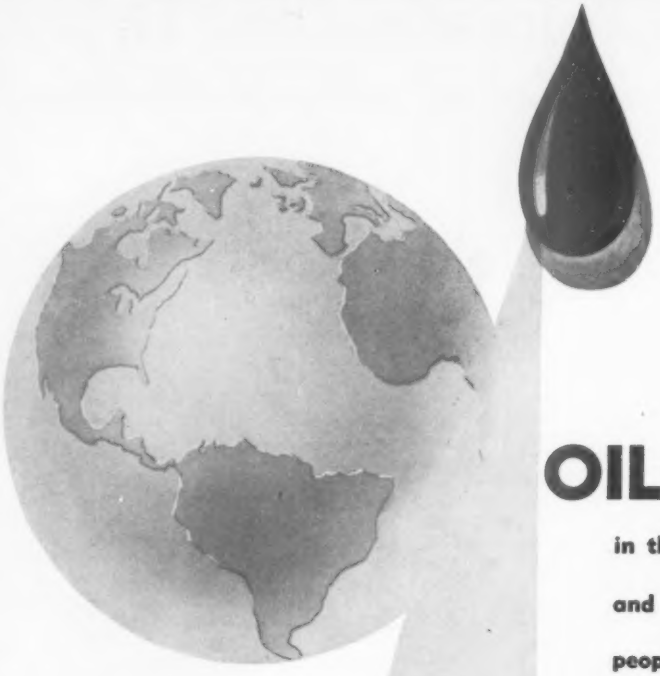
HIGHLIGHTS OF WEEK'S DEVELOPMENTS

MONTANA . . . Shell Oil Co. has completed 21-33-B-NP, C NE NW 33-22n-48e, in the Southwest Richey area of McCone County, for a gage of 177 bbl. of oil per day. Production is from Devonian in open hole between 9,185-9,260 ft., the first production from this formation in this area.

WEST TEXAS . . . Southeast Andrews County had another big discovery in the making at Shell 1-A University. First Ellenburger test at 12,540-75 ft. did not flow but recovered 6,750 ft. of oil. Second test at 12,575-12,600 ft. flowed oil in 26 minutes, gaging 152 bbl. in 1 hour, with no water. Location is 8 miles southeast of Andrews.

SOUTH DAKOTA . . . A Custer County wildcat, Emil Kucera 2 Barker, NW NE NW 34-6s-2e, is reported to have bailed 2 bbl. of fluid per hour, with the recovery 25 per cent oil, 75 per cent water. Operator is reportedly planning to install pump.

SOUTHEASTERN NEW MEXICO . . . Shell Oil Co. 1-CA State, Pennsylvanian discovery in 23-16s-36e, north of the Lovington fields, has been completed for a daily potential of 828 bbl. of 30°-gravity oil.



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Southwest Texas

New Pay Discovery Finaled in Duval

CORPUS CHRISTI.—A new pay discovery in Argo sand has been completed and shut in as a gas producer by Appell Drilling Co. of Alice, Tex. Discovery, 1 W. R. Peters estate, is approximately 20 miles southwest of Freer, in Duval County. New producer was perforated at 2,292-89 ft. interval; however, firm has not reported final gage of the new discovery. Company set 5½-in. production string to 2,740 ft., after running electrical log to 2,735 ft. Hole has been bottomed at 2,740 ft. Discovery is located on Survey 398, A-1697.

Arnold O. Morgan, operating out of Corpus Christi, has completed and shut in the 2 J. M. Elliott, possible new sand discovery, in San Patricio County, North Odem field. New producer was perforated at 7,824-35 ft. interval, and flowed an ungaged amount of gas distillate. Hole is bottomed to 8,415 ft., 5½-in. production casing cemented to 7,950 ft. Top of Frio was located at 7,824 ft. Previous production was encountered in Vicksburg at about 7,856 ft., in addition to being spotted in North Odem field, discovery is approximately 1½ miles southwest of Spartan field.

A new discovery is being made at Edwin W. Pauley et al 1 Lillian Parr et al, wildcat, located approximately 5 miles north of Concepcion in Duval County. Operator has set 4½-in. production casing which is cemented at about 6,100-ft. section. Hole has been bottomed to 6,400 ft. A mud logging unit was installed after setting surface casing. Production casing was run after encountering oil sands 5,902-20 ft. and side-wall cores indicated very good possibilities of production. Cores pulled at 5,920-30 ft. section showed shale and sand with very good oil odors. Drill site is on the A. J. Gonzales Heirs Grant, A-277.

Five miles southeast of Lopena Standard of Texas has confirmed a new gas discovery at its 1 I. Ramirez, wildcat in Zapata County. On open flow new producer flowed 7,800,000 cu. ft. of gas per day. Well was drilled to total depth of 12,565 ft. with 7-in. production string cemented to 10,387 ft. and 3,449 ft. of 5½-in. liner set with 2⅜-in. tubing swung to 9,011 ft. Drill-stem test was run on section 10,159-160 ft. using ¼-in. chokes, recovered undetermined amount of gas and distillate with bottom-hole pressure 3,750 to 6,700 psi. Nineteen-minute drill-stem test was run 10,155-190 ft. using ¼-in. chokes which flowed gas and distillate with bottom-hole pressure 3,760 to 6,100 psi. No information was released on the perforations but it is rumored to be completed from around 9,100 ft. zone with packer set at 1,935 ft. Drill-stem test on this zone 9,093-158 ft. flowed under 1,900 psi. working pressure on ¼-in. choke with recovery being considerable amount of gas and distillate and bottom-hole pressure of 6,500 psi. Located 3 miles to the southeast is Lopena field which has an anticlinal nosing structure. Deepest production for this area is around 7,000 ft. in the Wilcox zone which was topped in this well at 6,040 ft. Location is on the Jose C. Ramirez Survey.

SOUTHWEST TEXAS (DISTRICTS 1 & 4) WILDCAT FAILURES

Aransas County: Richardson & Bass 1 Unit 3 State of Texas Lse. 31902, Aransas Bay, dry, TD 11,161 ft.

Atascosa County: O. W. Killam 1 Harry Schreter, Jose Antonio Navarro Sur., A-9, dry, TD 5,726 ft.

Duval County: Jake L. Hamon 1 Z. Campos Est., M. S. Campos Sur., Sec. 224, dry, TD 9,005 ft.

Jake L. Hamon & Edwin L. Cox & Geo. H. Coates 1 J. T. Rigers, "El Mesquite" Trinidad Vela Grant, A-612, dry, TD 5,221 ft.

Frio County: J. E. Hillier 1 Alec Henson, W. H. Overstreet Sur. 4, A-1025, dry, TD 3,283 ft.

Jim Wells County: T. R. Cunningham 1 C. Ramirez, SK&K Sur., A-462, dry, TD 3,617 ft.

Magnolia Petroleum Co. 214 A. A. Seeligson, J. F. Dunn Sur., A-138, dry, TD 6,400 ft.

LaSalle County: San Jacinto Petroleum Co. 1 A. L. Krause, Atascosa County School Lands Sur., dry, TD 10,460 ft.

Nueces County: Appell Drilling Co. et al 1 G. C. Walton, Laureles Farm Tracts, Sec. 15, dry, TD 5,010 ft.

Travis County: S. A. Brewster & W. O. Bartle 1 Earl Tucker, Wayman Wells 36 Sur., dry, TD 4,505 ft.

San Patricio County: Sam E. Wilson, Jr. B-1 E. H. Lane, Coleman Fulton Pasture A-5, dry, TD 8,580 ft.

Starr County: Clark Fuel Producing Co.-J. L. Crump 2 Pedro Gonzales, Porcion 59, dry, TD 1,809 ft.

Starr County: Clark Fuel Producing Co.-J. L. Crump 3 Pedro Gonzales et al, Porcion 59, dry, TD 1,846 ft.

Starr Oil & Gas Co. 6 E. P. Caffarelli, Porcion 80, dry, TD 4,010 ft.

Webb County: Calvert-Manley 1 A. J. O. Walker, CCSD&RGNG Sur., dry, TD 1,667 ft.

W. Earl Rowe et al 1 A. Moos, CCSD & RGNG Sur. 64, dry, TD 4,210 ft.

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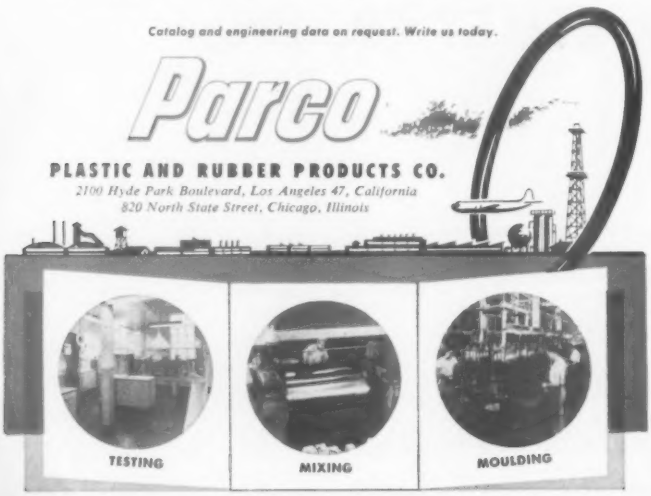

North-Central Texas

Taylor County Has New Flowing Reef Pay Success

WICHITA FALLS.—Moutray Moore Drilling Co. 1 Henry Sayles, Taylor County wildcat 10 miles south of Trent, completed as a flowing discovery. Potential was 131 bbl. of oil plus 23 bbl. of water, through 12/64-in. choke from reef pay at 4,122-37 ft. Location is in 63-5-T&P Survey.

Humble Oil & Refining Co. 1 Mrs. V. J. Kemper, 14-7-SP Survey, southeast Taylor County, had oil shows in Flippen sand. Drill-stem test from 2,177-91 ft. recovered 1,830 ft. of gas and 95 ft. of heavily oil-cut mud. Recovery at 2,189-2,201 ft. included 1,445 ft. of oil and 90 ft. of heavily oil and gas-cut mud, and from 2,201-11 ft. recovery was 50 ft. of oil-cut mud, plus 180 ft. of salt water. It was drilling ahead on a 5,500-ft. contract.

Humble 1 Graham, 269-64-H&TC, in Black Strawn field, had prospects of a new pay section. Drill-stem test in reef limestone from 3,498-3,505 ft. had gas in 10 minutes and recovered 2,430 ft. of oil and 90 ft. of heavily oil and gas-cut mud.

Walter L. Plemons Production Co. will drill 1 J. R. Ramsy as a 5,500-ft. wildcat in Section 6, BS&F Survey, 10 miles southwest of Jacksboro. Russell Maguire will drill 1 Gladys Johnson as a 6,000-ft. wildcat in the W. Thompson Survey, A-608, 3 miles northwest of Jacksboro.

In Grayson County, Flaitz and Mitchell 1 Kay Kimbell, 5 miles southwest of Sherman, was dry at 8,112 ft. Drill-stem test at 8,035-63 ft. recovered the water cushion plus 4,200 ft. of salt water.

Humble Oil & Refining Co. 1 Mark Williams, northwest of Sandusky, was drilling below 11,150 ft. in shale. Drill-stem test at 10,993-11,024 ft., open 20 minutes, recovered 30 ft. of drilling mud.

NORTH CENTRAL TEXAS (DISTRICTS 9 & 7-B) SUCCESSFUL WILDCATS

Coleman County: Bay Petroleum Corp. 1 Mary Dunman, 28-2-T&NO, TD 3,845 ft., elev. 1,970 ft., pay 3,665 ft., IP 78 bbl. 40°-gravity oil, 16/64-in. choke, TP 200 psi., GOR 935 cu. ft.

J. W. Laster 1 Yarbrough, Sec. 743, B. Ferguson Sur., TD 918 ft., elev. 1,676 ft., pay 907 ft., IP pumped 20.6 bbl. 38°-gravity oil.

NORTH CENTRAL TEXAS (DISTRICTS 9 & 7-B) WILDCAT FAILURES

Archer County: Lomax and Maxwell 1 B. W. Garvey, Sec. 1,887, TE&L, dry, TD 1,081 ft.

Lomax and Maxwell 1 Theresa Kovar, Sec. 2,438, TE&L, dry, TD 1,530 ft.

Sid Perryman and Oltex 1 R. H. Kunkel, Blk. 47, D. G. Thomas Sur., A-458, dry, TD 1,498 ft., Gunsight 1,446-49 ft.

Baylor County: Deep Rock Oil Corp. 1 A. F. Wirz, Sec. 146, T&NO, dry, TD 6,000 ft.

Wm. H. McCluskey 1 T. W. Farr, P. L. Leaman Sur., A-264, dry, TD 5,124 ft., elev. 1,392 ft., Palo Pinto 3,455 ft.

Brown County: E. L. Dunn and J. B. Kerby 1 Joe C. Brooks, Sec. 755, S. Hankins Sur., dry, TD 1,393 ft.

Callahan County: W. H. Metzner 1 Lucy Whitehead, Blk 355, George Hancock Sur., dry, TD 1,759 ft.

Clay County: Tom B. Medders 1 E. B. Nutter, Sec. 31, WCRR Sur., dry, TD 4,326 ft.

Coleman County: Western Petroleum Co. 1-36 W. Curtis Beck, 36-1-GH&H, dry, TD 3,375 ft.

Comanche County: Rogers & Thomas 2 Fannie Lee Grimes, Singleton Thomas Sur., dry, TD 200 ft.

Eastland County: Bankline Oil Co. 2-B George P. Fee, 65-4-H&TC, dry, TD 3,488 ft. Greenbrier Oil Co. 1 Mary Stansell, 3-3-H&TC, dry, TD 3,741 ft.

Erath County: J. L. Slusher 1 Grady Waters, M. A. Bingham Sur., dry, TD 1,860 ft.

Haskell County: Theo. Hamm Brewing Co. 1 Laura Williams, 3-A152-GH&H, dry, TD 4,200 ft.

Jones County: W. M. Jarrell 1-B W. T. Davis, 40-15-T&P, dry, TD 555 ft.

Palo Pinto County: Homer S. Head 2 Lillie Humphries, Sec. 1,775, TE&L Sur., dry, TD 1,994 ft.

Stephens County: Cosden Petroleum Corp. 2 C. H. Compton, Sec. 2,254, TE&L Sur., dry, TD 4,284 ft., elev. 1,256 ft., Duffer 3,908 ft., Ellenburger 4,196 ft.

Delta Oil Co. 1-B Bernie McCrea, Sec. 383, SPRR, dry, TD 4,202 ft., elev. 1,415 ft., Marble Falls 3,865 ft., Barnett shale 3,985 ft., dolomite 4,182 ft.

Stonewall County: General Crude Oil Co. 1 Mattie Oldham 37-D-H&TC, dry, TD 6,465 ft., elev. 1,770 ft., dolomite chert 6,160 ft.

Taylor County: D. C. Casey 1 Bill Hays, Blk. 4, D. B. Carley Sur., dry, TD 2,800 ft.

Wichita County: H. W. Weir 1 Jackson, Sec. 9, Blk. 4, DCSL Sur., A-417, dry, TD 1,628 ft.

Wilbarger County: K L B Drilling Co. 1 W. T. Waggoner Est., 21-5-H&TC, dry, TD 2,445 ft.

Young County: Timberlake, Kelleher & Scott 1 D. B. Spearman, Wm. Stoneman Sur., A-250, dry, TD 3,815 ft.

The new producer is Spartmac-Mic MacBay 1 Legal, in LSD 3, 21-57-25w4, ¾ of a mile northwest of Imperial 15-16 Viking oil well. Crew ran 1-hour drill-stem test from 2,784-94 ft. Natural gas flowed immediately, oil-cut mud flowed in 25 minutes, and a spray of 35°-gravity crude oil reached the surface in 30 minutes. Fluid recovery was 220 ft. of clean oil no water. Test from 2,794-99 ft. flowed gas in 3 minutes, at rate 106,000 cu. ft. daily and yielded oil in 59 minutes. Recovery was 1,370 ft. of clean oil. Latest test, from 2,799-2,805 ft. flowed gas in 3 minutes at rate 130,000 cu. ft. daily, and flowed oil in 36 minutes. Pipe recovery was 1,850 ft. of oil, no water. Coring and testing is being continued.

Six Calgary oil firms, headed by High Crest Oils, Ltd., have successfully completed their Malmo area oil well from the D3 Devonian and Lower Cretaceous formations, the first Alberta well to be dually completed from those two horizons. This Malmo project lies on farmout lands from Canadian Superior Oil of California, Ltd., 125 miles northeast of Calgary.

The new producer is High-Crest-Albermont-Leduc Consolidated 1 Malmo, in LSD 3, 23-44-22w4, ¼ mile north of Sun 14-4 McCarty & Coleman oil well. Hole was completed in D3 at 5,287 ft., with string of production casing set at 5,270 ft. Casing was perforated opposite the Cretaceous sand for production, while bottom 17 ft. of D3 was left open. Initial potential tests through an 18/64-in. choke rated a combined flow of 680 bbl. daily, including 302 bbl. per day from D3 and 378 bbl. per day from the Cretaceous.

CANADIAN SUCCESSFUL WILDCAT

Chamberlain 1-33 Bindloss, LSD 1, 33-22-4w4, TD 3,668, capped gas well.

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Canadian Fields

Madison Strike Assured in Buck Lake-Minnehik Area

CALGARY.—Canadian Delhi Oil, Ltd., and its associates in a step-out venture in the Buck Lake-Minnehik area of central west Alberta have been assured of success in the Madison limestone, as drill-stem tests in that formation flowed natural gas at rates up to 4,500,000 cu. ft. daily and sprayed distillate to the surface.

The current well, Canadian Delhi et al 2 Minnehik, in LSD 11, 16-46-6w5, is 1¼ miles northeast of the No. 1 wet gas discovery, 55 miles west of Wetaskiwin and 60 miles southwest of Edmonton.

The 2 Minnehik topped the Madison limestone at 6,823 ft., or 3,798 ft. subsea, 51 ft. lower than the Madison contact at the discovery well. Crew cored to 6,834 ft. and ran 50-minute drill-stem test from 6,819-34 ft. Natural gas flowed to the surface immediately, increasing to rate of 4,500,000 cu. ft. daily in 40 minutes. Distillate sprayed to surface in 13 minutes, and recovery was 3 ft. of distillate. Flowing pressure was 1,150 psi., while shut in pressure was 2,500 psi.

An additional 12 ft. was cored in the Madison, and test from 6,834-46 ft. flowed natural gas at rate 4,100,000 cu. ft. daily at end of 70 minutes. Packer stuck in hole as crew attempted to pull out, and was still in hole at last report this week.

A team of four Edmonton-based Canadian independents and a Calgary-based American firm have found Viking sand oil production at their initial driller in the Legal area of central Alberta, 25 miles north of Edmonton. The well sprayed oil to the surface in 30 minutes on initial Viking sand drill-stem test.

particularly when setting casing or liners in a tight hole, by running a Baker Rotary Wall Scraper. It provides a safe, positive, low-cost method of enlarging the diameter of an open hole for cleaning up oil sands and increasing the productive area; for gravel packing; for directional drilling and sidetracking. Seven basic body sizes provide for hole enlargement from 4¾" minimum to 36" maximum by progressively changing to larger blades.

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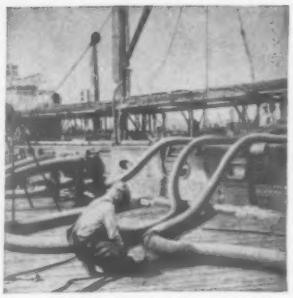

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CANADIAN WILDCAT FAILURES

Marigold-Seaboard 1 Carmangay, LSD 8, 7-14-21w4, TD 4,917 ft.

Quinalta 1-6-14 Consort, LSD 6, 14-33-5w4, TD 4,500 ft.

Canroc 1 Vilna, LSD 10, 5-59-13w4, TD 2,250 ft.

EASTERN CANADA

Gaspe.—In Gaspe North, Quebec Province, New Peninsular Oil 1, resumed late in October is below 5,597 ft. after getting the St. Alban limestone above 5,450 ft. Potential production horizon is a coral reef formation around 6,350 ft. Gas and water at higher levels have been sealed off, and casing cemented as a precaution against possible high gas and oil pressure.

Ontario.—In Brant County, east of Paris, Alberta Oil Co. is leasing extensive acreage preparatory to drilling. Leases are in an area of 6 square miles between Concessions 2 and 3 from the Grand River to No. 24 highway. Shallow gas has been encountered in various parts of Brant County, and deeper drilling for oil is now contemplated.

South Louisiana

Testing Under Way at St. Landry Prospect

NEW ORLEANS.—Sohio Petroleum Co. is now testing the 4 Thistlewaite Lumber Co., St. Landry Parish, after well flowed at rate of 227 bbl. of oil per day on 9/64-in. choke. Tubing pressure was 1,300 psi., gas-oil ratio 714-1 and 40° gravity. Operator drilled to total depth of 9,350 ft. and set 7-in. casing at 9,220 ft. Perforations were shot at three intervals, 7,842-46 ft.; 7,848-52 ft.; and 7,856-60 ft. Possible new pay is located in the midst of Washington gas-distillate field producing from the 9,300-ft. zone. Discovery for the field was operators 1 Thistlewaite Lumber Co., Section 64-4s-4e, which flowed from perforations 9,287-91 ft. and estimated 1,750,000 cu. ft. of gas per day on 10/64-in. choke. Also operator's 3 Thistlewaite Lumber Co., Section 63-4s-4e, produced from perforations 9,333-43 ft. with potential of 70 bbl. of distillate plus 1,000,000 cu. ft. of gas per day on 9/64-in. choke. New oil producer is located approximately 6 miles southeast of Begg, Section 61-4s-4e.

Humble Oil & Refining Co. is testing its 1 M. J. Kahac et al, West Baton Rough Parish, Lobdell confirmation, after perforating 7-in. casing at 8,884-90 ft. Initial 1½-hour drill-stem test with packer set at 8,860 ft. on 3/16-in. chokes, well flowed 1,040,000 cu. ft. of gas per day plus small amount of distillate. Previous test on perforations 8,722-26 ft. flowed salt water and rathole mud. This attempted confirmation is to Circle Drilling Co. 1 Catherine Sugar Corp., Lobdell field discovery, Section 37-7s-11e, which produced potential flow of 322 bbl. of oil per day on 3/16-in. choke, from perforations 9,313-30 ft. Location is in Section 82-7s-12e.

SOUTH LOUISIANA SUCCESSFUL WILDCAT

St. Landry Parish: Sunray Oil Co. 1 Simon LaLonde, Sec. 116-6s-4e, TD 12,558 ft., IPF 28 bbl. of oil plus 560,000 cu. ft. of gas per day, 12/64-in. choke, 46°-gravity oil, gas-oil ratio 200,000-1.

SOUTH LOUISIANA WILDCAT FAILURE

Acadia Parish: Sunray Oil Corp. 1 Pierre Cormier, Jr., Sec. 15-11s--1e, dry, TD 10,881 ft.

Texas Gulf Coast

New Pay Opened in Grimes' Retreat Field

HOUSTON.—Atlantic Refining Co. has plugged back and opened a new pay in a higher zone in 1 E. R. Sanders, second well completed in the two-well Retreat field of Grimes County, 12 miles southeast of Navasota. Hole was plugged back from 10,495 ft. to 7,785 ft. and completed through 40 perforations at 7,768-78 ft. for initial potential of 119.10 bbl. of 37.3°-gravity oil per day on 10/64-in. choke. On test, tubing pressure registered 600 psi. and gas-oil ratio was 890-1 with a trace of water in the flow. Well was originally completed at 10,368-78 ft. for 77.2 bbl. of 35°-gravity oil on a ⅛-in. choke, tubing pressure 675 psi., gas-oil ratio 1,680-1, with 0.1 per cent water, July 1952. Field was opened by Gulf Oil Corp. 1 Wm. Gardner in December 1951, for 142 bbl. of pipeline oil per day on 9/64-in. choke through perforations at 10,392-405 ft., tubing pressure 975 psi. Gulf Oil Corp.'s second test in the area was drilled at 2 Wm. Gardner 2,650 ft. north of the discovery well. Hole was drilled to total depth of 11,616 ft. and abandoned.

Hassie Hunt Trust is preparing to set production string at two Gulf Coast wildcat tests in Galveston and Liberty counties. In Galveston County, 2 miles northeast of Alta Loma field production and 1 mile south of Alta Loma, 1 Mrs. A. David has been drilled to total depth of 10,910 ft. and survey run to bottom. Venture is on the Lemuel Crawford Survey, A-48.

Meanwhile 1½ miles southeast of Cottonwood field and 8.8 miles southeast of Devers in Liberty County, crews are running 5½-in. casing at Hassie Hunt Trust 1 E. W. Boyt et al. Test is bottomed at 8,603 ft. Well is located on the J. A. Bellar Survey, A-982.

Oil and Chemical Products, Inc., 1 Jessie A. Tucker, middle Yegua oil discovery, was completed in Harris County, approximately 1 mile of North Delhi gas production and 35 miles west of Houston. Through 12 perforations at 6,788-90 ft., well flowed 128.34 bbl. of 39°-gravity oil per day on 24-hour potential test on ¼-in. choke. Tubing pressure was recorded at 880 psi. with no water and gas-oil ratio 780-1. Firm reported that three additional sands, capable of commercial production, were found in the middle and lower Yegua zone. Hole was drilled to toal depth of 7,335 ft. and 5½-in. casing cemented on bottom with 2-in. tubing swung at 6,758 ft. Well is on the H&TC Survey, A-1388.

TEXAS GULF COAST (DISTRICTS 2 & 3) WILDCAT FAILURES

Chambers County: Wheelock & Weinschell 1 J. T. White, James McGahey Sur., A-18, dry, TD 8,954 ft.

DeWitt County: Arkansas Fuel Oil Co. 1 J. H. Prigden, SA&MG RR Sur., A-446, dry, TD 8,500 ft.

Fort Bend County: Liberty Work-Over & Drilling Co. 1 G. R. Huntington, David Randon Sur., A-75, dry, TD 8,510 ft.

Galveston County: Cities Service Corp. 1 K. T. Wiedemann, S. F. Austin Sur., A-4, dry, TD 9,800 ft.

Goliad County: Quin Drilling Co. 1 B. M. Lucas et al, W. P. Miller Sur., A-193, dry, TD 5,550 ft.

Jefferson County: Chance Drilling Co., Inc. 1 J. M. Pivoto, John Blair Sur., A-4, dry, TD 8,503 ft.

Karnes County: F. William Carr 1 J. B. Cannon, Antonio Lombrano Sur., TD 7,820 ft.

Del Mar Drilling Co. 1 David Banduch, Andrew Hernandez Grant, dry, TD 7,600 ft.

Victoria County: P. R. Rutherford-Heep Oil-Herman F. Heep 1 Mrs. Ben Shelton et al, Pacedo Benavides Sur., A-124, dry, TD 8,078 ft.

Eastern Texas

Waskom Field in Harrison Extended to the North

DALLAS.—LeCuno Oil Co. 1 Winston B. Taylor, J. Barrentine Survey, A-108, has completed from this upper and lower Pettit limestone, extending Waskom field of Harrison County about 1½ miles to the north.

Potential from the Byrd zone at 5,971-78 ft. was 14,600,000 cu. ft. of gas daily plus 165 bbl. of distillate, and perforations in the Page zone at 6,075-78 ft. gaged 2,200,000 cu. ft. of gas plus 64 bbl. of distillate. Tops reported were the Pettit at 5,850 ft. and Travis Peak at 6,153 ft. on elevation of 315 ft.

Atlantic Refining Co. 1 Frost Lumber Co., Shelby County test northeast of Martinsville, has plugged back from 8,300 ft. to 1,390 ft. to test oil shows logged in sand while drilling.

Plans for an Ellenburger wildcat to be drilled in northwest Ellis County, near the town of Midlothian, have been reported. Johnny Mitchell, Houston, was said to have filed a lease agreement which included the drilling of an Ellenburger test, or to around 9,000 ft. Mitchell holds considerable acreage west and southwest of town.

Bert Fields was moving in to retest at 1-A

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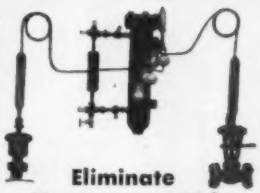

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Purse, a 7,300-ft. dry hole 6 miles southwest of Tatum in Daniel Martin Survey. Testing was to be made around 7,000 ft.

EAST TEXAS (DISTRICTS 5 AND 6) WILDCAT FAILURES

Navarro County: Humble Oil & Refining Co. 1 First National Bank of Corsicana, Robt. Caradine Sur., A-139, 8 miles S Kerens, dry, TD 13,062 ft.

Wood County: A. O. Phillips 1 Archie McGee, John Allen Sur., A-20, 2 miles W Quitman, dry, TD 4,973 ft.

Louisiana-Ark.

Operator Coring Ahead At Smackover Wildcat

SHREVEPORT.—The California Co. is coring ahead at 8,070 ft. at 1 Lillie Mae Moore Smith, NW SE 29-18s-17w, proposed 8,700-ft. Smackover wildcat south of Schuler field in Union County. Two drill-stem tests have been made in the Smackover. The tests were from 8,014-39 and 8,039-61 ft.

Kirby Petroleum Co. found about 9½ ft. of sand in the Blossom zone at 2-A Southern Co., Section 18-16s-14w, Calion area, northern Union County, and is waiting for pumping equipment to complete. This is the third well in the new Calion area and is northeast diagonal offset to the discovery well. The southeast offset will complete in the Graves sand from 2,491-93 ft.

Carter Oil Co. is taking a drill-stem test series in the Smackover at 1 Goodwin et al, SW NW 28-16s-12w, wildcat ¼ mile south of Moro Bay in northern Union County. The wildcat is bottomed at 5,053 ft. after finding showings of heavy black oil in the Travis Peak and Cotton Valley formations, but results have not been of commercial importance.

Lion Oil Co. has logged a sand showing oil in the Meakin and Graves sands and has plugged back and set production casing at 1 Pendleton, NW SE NW 24-18s-15w, on the west edge of Hibank field.

Louisiana.—Justiss-Mears Oil Co., Inc., is preparing to rig up pumping equipment at B-5 Tensas Delta Land Co., C SW SE 28-5n-5e, wildcat 1 mile east of Saline Lake field, southern Catahoula Parish, eastern-central Louisiana. Bottom of the hole is at 6,212 ft. and cased to 5,746 ft. Perforations were made in a Wilcox sand at 5,652-55 ft. and well failed to kick off.

Skelly Oil Co. completed 1-B Wasson, SE NW 13-22n-5w, second well and new pay opener in Summerfield field, Claiborne Parish. Production is from perforations at 10,374-428 ft. in Smackover. The discovery flowed 32 bbl. of 52°-gravity condensate and 186,000 cu. ft. of gas per day.

Magnolia Petroleum Co. is continuing to test at their southeast offset to the Summerfield discovery well at 1 Hightower, C SW SW 18-22n-4w. The operator has perforated from 10,860-900 ft. and is testing after acidizing.

LOUISIANA WILDCAT FAILURE

Bossier Parish: Casey & Weempe Oil Co. 1 Scanland, C NW SW NW 29-19n-11w, dry, TD 2,750 ft.

ARKANSAS WILDCAT FAILURES

Calhoun County: Alcan Oil Co. 3 Calion Lumber Co., C NW NW NE 21-15s-14w, dry, TD 3,012 ft.

Columbia County: Robt. A. Stacy et al 1 Hines, C NE NE 36-19s-21w, dry, TD 5,997 ft.

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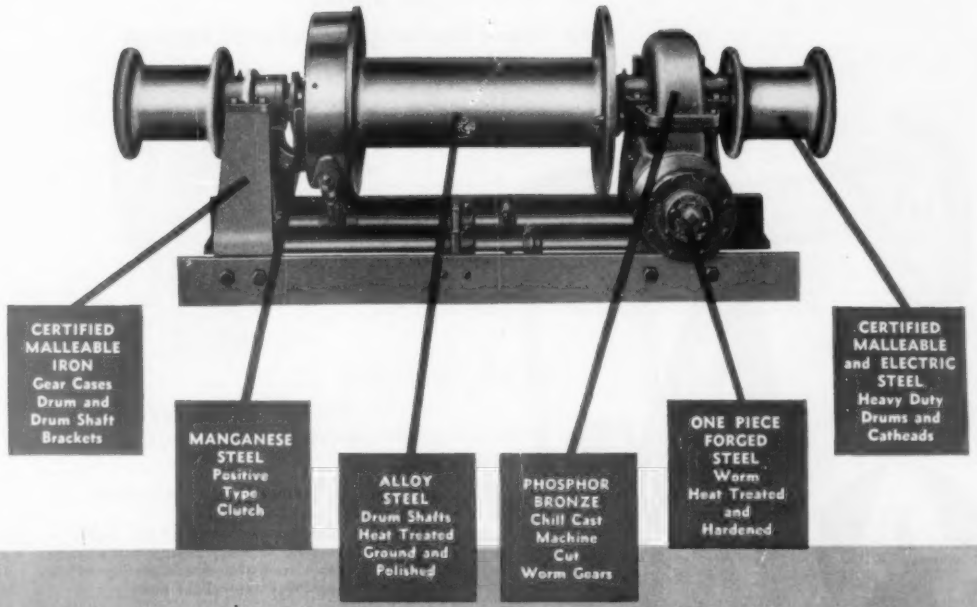
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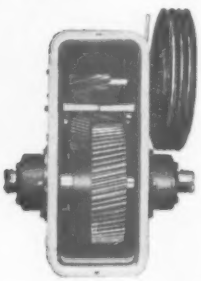

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Washita Wildcat Makes Gas-Distillate Producer

SHELL OIL CO. has completed production tests at its 1 Adams, deep gas-distillate discovery well in western Washita County, in the western part of the state. On its final completion gage, the well flowed 28 bbl. of distillate and 3½ bbl. of water with 2,018,000 cu. ft. of gas in a 24-hour period through 22/64-in. choke on the tubing. Flowing pressure on the tubing was 850 psi. Gravity of the distillate was 55.3° A.P.I.

Production is from the Des Moines granite wash, opposite which casing is perforated in two intervals, 11,066-92 ft. and 11,362-92 ft. Spot location is in the C SE SE 6-9n-19w, which is 6 miles west of Dill, and about 5 miles southeast of the Elk City field, nearest production. Hole was drilled to 12,500 ft. and has casing run to 11,475 ft. with bottom plugged back to 11,416 ft.

Parker Drilling Co. has suspended production tests in Springer sand at its 1 Boyd Miller, deep wildcat in the C NE SW 22-15n-16w, 3 miles north of Independence, northern Custer County, and is preparing to test shallower horizons in which good showings were encountered while drilling. During tests of the Springer sand, opposite which casing was perforated at 11,510-65 ft., the well flowed at rates up to 1,500,000 cu. ft. of gas and 8 to 10 bbl. of distillate per day. Production declined, however, to less than 50,000 cu. ft. of gas per day. Plug has been set above this zone for testing the shallower horizons. Promising showings were encountered in both the Deese sand at 10,213-43 ft. and the Hoxbar at 8,650-8,750 ft.

Deep Rock Oil Corp.'s indicated discovery well, 1-A Griffin, C NE SW 31-12n-13w, south of Hydro, in northwestern Caddo County, near the Custer County line, got a good flow of gas and filled 2 stands with distillate and 10 stands with distillate-cut water cushion in a preliminary drill-stem test of its prospective Deese-sand pay in open hole at 11,865-12,214 ft. At latest report, tubing was being run for completion tests.

Production of the Northeast New Hope field at the north end of the Golden Trend development in McClain County is being extended more than ½ mile northward where Magnolia Petroleum Co. has oil string run to complete its 1 Harris, C SW SW 25-5n-3w. The well flowed at the rate of 28 bbl. of oil per hour in a drill-stem test of Hart sand at 7,251-80 ft. Total depth now is 7,360 ft. with casing at 7,359 ft.

Stanolind Oil & Gas Co. has completed another well, the fourth, in the development of Springer production in the Northeast Gotebo pool, northern Kiowa County. The new producer, 2 Kennedy, NE SE NW 2-7n-16w, a location south of the discovery well (1 Kennedy), flowed 211 bbl. of oil in 4 hours through ½-in. choke, with gas at the rate of 1,850,000 cu. ft. per day, on its completion gage. Pay zone is open through casing perforations at 5,742-5,831 ft. Gulf Oil Corp. also has two producers in the pool, its 1 and 2 Voyles, located east of Stanolind's two wells. The pool was opened last January.

Phillips Petroleum Co. appears to have uncovered a new Simpson sand reservoir in northeastern Stephens County at its 1 Oakman, SE NE SE 2-1n-4w. A 60-minute drill-stem test at 7,462-72 ft. in the Simpson got gas in 5 minutes and recovered 4,110 ft. of 40.1°-gravity oil. Pay has been passed up for the time being for a look at lower potentially productive horizons. Location is 1½ miles west of a shallow sand (3,600-ft.) pool opened earlier this year by Shell Oil Co. at 1 Rose.

OKLAHOMA SUCCESSFUL WILDCAT

Coal County: Sohio Petroleum Co. and Beach & Talbot 1 Guth, NW SE NW 22-2n-8e, flowed 25 bbl. of oil per hour from Bromide 6,884-90 ft., 6,907-17 ft., TD 7,531 ft.

OKLAHOMA WILDCAT FAILURES

Carter County: Quintin Little and Cumbie & Collins 1 Brady, SE SW SE NW 17-1s-2w, dry, TD 1,885 ft.

A. D. Britton 1 Lane, SE SE SW 35-4s-3w, dry, TD 2,480 ft.

Creek County: Glenn Cole and W. S. Bogie 1 Matherly, SW SW NE 17-18n-8e, dry, TD 2,812 ft.

Grant County: Adkins Drilling Co. 1 State, NW NW SW 16-24n-4w, dry, TD 5,987 ft.

Champlin Refining Co. 1 Anna Field, NW NW SE 29-25n-5w, dry, TD 6,196 ft.

Lincoln County: Sun Oil Co. 1 Lanyon, NW NW SE 14-12n-2e, dry, TD 5,746 ft.

Nadel & Gussman 1 State, SE SE SE 16-12n-6e, dry, TD 4,685 ft.

McElroy Ranch Co. 1 Grimes et al, NW SE SE 11-13n-5e, dry, TD 4,950 ft.

Nadel & Gussman 1 Heller, NE NE SW 30-15n-2w, dry, TD 5,384 ft.

Nadel & Gussman 1 School Land, SW SW SE 16-15n-4e, dry, TD 5,006 ft.

Earl E. Barnes 1 Trawoke, NE NE SW 30-15n-5e, dry, TD 3,902 ft.

Okfuskee County: Evans & Halbert 1 McCoy-Brown, NW NW SE 5-12n-9e, dry, TD 3,467 ft.

Washita County: Champlin Refining Co. 1 Hiever, SW SW NW 30-8n-26w, dry, TD 10,041 ft.

Phillips Petroleum Co. 1 Armstrong, C SW NW 35-10n-19w, dry, TD 11,519 ft.

Permian Basin

Ellenburger Shows Found At Upton County Wildcat

MIDLAND.—Gulf Oil Corp. 1 McElroy Ranch State, Upton County wildcat northeast of Crane, found shows of oil in the Ellenburger, below Ellenburger sections carrying salt water.

A core from 12,076-110 ft. recovered 34 ft. of slightly fractured dolomite, vuggy and with good porosity and slightly bleeding oil. Drill-stem test from 12,087-180 ft. recovered 320 ft. of gas-cut mud and a light show of oil in the bottom 30 ft. There was no formation water. A previous drill-stem test at 11,959-12,058 ft., open 3 hours, recovered 300 ft. of gas-cut mud and 180 ft. of mud-cut water. At last report the well had cored 53 ft. of dolomite with some porosity but no shows from 12,187-242 ft.

The Texas Co. will drill a deep wildcat in Upton County, 2½ miles south of production in Wilshire-Ellenburger field. The proposed test will be the 1 Josephine Herbert Graf, located on a 480-acre tract in Section 102. Projected depth was 13,000 ft.

Magnolia Petroleum Co. 1-CA Fasken, Andrews County, developed 1,500 ft. of water blanket slightly cut with oil and gas, and 4,890 ft. of salty sulfur water on a 3-hour test between 12,766-88 ft. Operators drilled ahead and prepared to test to 12,840 ft.

Offsetting the Magutex discovery to the north, Magnolia 1 University, 36,991, had plugged back to 13,918 ft. and was swabbing load-oil, on perforations at 13,909-18 ft. South of the discovery, Magnolia 1 University, 36,995, had total depth at 13,837 ft. and prepared to core ahead.

Texas Gulf Producing Co. 1 Headlee, Ector County wildcat northeast of Odessa, had tentative top of the McKee sand at 12,710 ft., and was drilling ahead at 13,048 ft. A 3-hour test in the Fusselman section at 12,410-72 ft. developed 30 ft. of slightly gas-cut mud.

Phillips Petroleum Co. 4-EE University, between the new Block 12-Ellenburger field and the older Block 12, Clear Fork and Devonian, pool, developed oil on a drill-stem test of the Devonian at 8,245-8,430 ft. Recovery in 30 minutes was 3 joints of gas-cut mud and 5,336 ft. of 46°-gravity oil. Drilling continued on a 11,000-ft. contract.

Phillips Petroleum Co. 1-C Schar, Martin County wildcat southwest of Lenorah, developed 50 ft. of oil, 1,531 ft. of slightly oil and gas-cut water blanket and 185 ft. of oil-cut mud on drill-stem test in the Wolfcamp at 9,832-75 ft. Another test at 9,956-10,044 ft., also in the Wolfcamp, recovered 10 ft. of free oil and 1,682 ft. of slightly oil and gas-cut salt water. Drilling continued on a 14,000-ft. contract.

In Terry County, Fred Turner 1 May was reported drilling ahead at 10,077 ft. Reef limestone, topped at 10,050 ft., tested mud with no shows.

In western Midland County, Plymouth Oil Co. had prospects of confirmation production at its 1-B Foster, a north and slightly west offset to the Strawn discovery. Production tests were to be made on a pay section between 10,582-652 ft.

Gulf Oil Corp. 1 Northrup, Reeves County wildcat, was drilling in sand and shale at 12,637 ft.

In the Glenna gas area of Pecos County, Phillips' four deep tests were drilling ahead. These were: Phillips 1-A Puckett B, drilling 11,550 ft.; 1-C, drilling 11,237 ft.; 1-D had stuck drill pipe at 11,126 ft.; 1-E, drilling 8,347 ft.

WEST TEXAS (DISTRICTS 8 AND 7-C) SUCCESSFUL WILDCATS

Andrews County: The Texas Co. 1-AB State, 22-5-University, TD 12,667 ft., elec. 3,034 ft., Devonian 12,603 ft., pay 12,595 ft., IP pumped 133 bbl.-gravity oil, GOR 16 cu. ft.

Ector County: J. D. Wrather Jr. 1 G. T. Hall, 7-B15-PSL, TD 11,099 ft., elev. 2,997 ft., Fusselman 9,765 ft., pay 9,830 ft., IP 173 bbl. 42°-gravity oil, ¾-in. choke, TP 50 psi., GOR 1,115 cu. ft.

Garza County: Duncan Drilling Co. 1 Davis, 80-5-GH&H, TD 2,825 ft., elev. 2,461 ft., pay 2,741 ft., IP pumped 22 bbl. 39°-gravity oil.

Pecos County: Standard Oil Co. of Texas 1-A Claude Owens, 2-C4-GS&SF, TD 9,990 ft., elev. 2,689 ft., pay 9,705 ft., IP pumped 106 bbl. 38°-gravity oil, GOR 346 cu. ft.

WEST TEXAS (DISTRICTS 8 AND 7-C) WILDCAT FAILURES

Andrews County: Phillips Petroleum Co. 1-FF University, 28-10-University, dry TD 12,726 ft., elev. 3,223 ft., Pennsylvanian 8,750 ft., Devonian 10,535 ft., Simpson 11,915 ft., Ellenburger 12,535 ft.

Coke County: Seaboard Oil Co. of Delaware 1 Marvin Simpson, Sec. 4, L. B. Harris Sur., dry, TD 6,100 ft.

Union Oil Co. of California 1 G. C. Bell, T&GN Sur., 3 miles SE Bronte, dry, TD 5,555 ft., Cisco 5,380 ft., Palo Pinto 4,260 ft.

Culberson County: Richardson & Bass 1 Grisham-Hunter, 22-54-PSL, dry, TD 10,008 ft., elev. 3,542 ft., Wolfcamp 8,660 ft., Devonian 9,906 ft.

Dawson County: W. A. Moncrief 1-89-Scan-

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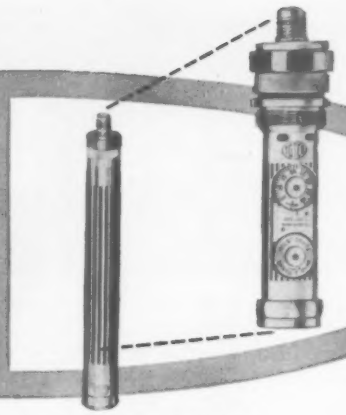

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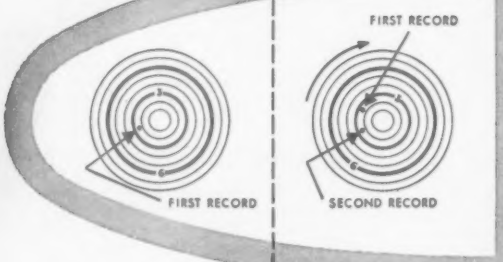

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lan, 89-M-EL&RR, dry, TD 9,658 ft., elev. 3,147 ft., Spraberry 7,722 ft., Canyon 9,410 ft.

Glasscock County: Sinclair Oil & Gas Co. 1 G. T. Hall, 6-34-T2S-T&P, dry, TD 11,072 ft., elev. 2,564 ft., Pennsylvanian 9,764 ft., Mississippian 10,332 ft., Silurian 10,500 ft., Ellenburger 10,863 ft.

Hale County: Lawless Drilling Co. 1 Harmell, 5-4-EL&RR, dry, TD 6,815 ft., elev. estimated 3,329 ft., Clear Fork 4,355 ft., Wolfcamp porosity 5,935 ft.

King County: Frank Wood Associates 1 Gillespie, 107-F-H&TC, dry, TD 6,590 ft., Caddo 6,014 ft., Ellenburger 6,480 ft.

Pecos County: Phillips Petroleum Co. 1-R Puckett, 45-101-T&C, dry, TD 3,200 ft.

Reagan County: C. E. Hyde 1 University, 28-11-University, dry, TD 10,025 ft., elev. 2,756 ft., Devonian 9,360 ft., Simpson 9,830 ft., Ellenburger 9,935 ft.

Winkler County: Ben J. Taylor 1 Evelyn Lineberry, 7-C22-PSL, dry, TD 3,805 ft.

TEXAS PANHANDLE

Gulf Oil Corp. continues drilling or testing at 6 wells in the Quinduno field area, Roberts County, the Panhandle's most active single area. Most development is in the 3,900-4,100 ft. Brown dolomite pay.

J. M. Huber Corp. has set casing in the first offset to the discovery well of Womble pool in Hansford County, 8 miles west of Morse and just east of Ideal, Texas. The confirmation try is the Huber 1 Ownbey, 660 ft. from north and east lines, Section 35, Block 3-T, GH&H Survey with total depth at 5,396 ft.

TEXAS PANHANDLE (DISTRICT 10) WILDCAT FAILURES

Gray County: Gulf Oil Corp. 1 City of Pampa, 78-3-I&GN, 1½ miles E Pampa, dry, TD 3,750 ft.

Gulf 1 Oregon, 92-3-I&GN, 1 mile NE Pampa, dry, TD 3,750 ft.

Roberts County: Gulf 1 Clark, 197-M2-BS&F, 9 miles NW Miami, dry, TD 4,066 ft.

Wheeler County: Sun Oil Co. 1 Hilliard, 4-A5-H&GN, 4 miles S Mobeetie, dry, TD 4,140 ft.

SOUTHEAST NEW MEXICO

Shell Oil Co. 1-CA State, Pennsylvanian discovery in 23-16s-36e, north of the Lovington fields, has been completed for a daily potential of 828 bbl. of 30°-gravity oil. Production was through 22/64-in. choke from open hole at 11,342-520 ft.

Continental Oil Co. 1-B-28 Burger, 28-20s-38e, extended Drinkard production to the east with a daily potential of 66 bbl. of 40°-gravity oil. Completion gage was through 20/64-in. choke on perforations at 6,729-59 ft.

Operators were reconditioning 9⅝-in. casing set at 4,189 ft. at Continental Oil Co. 1 Anderson Ranch, 11-16s-32e, Lea County wildcat southwest of South Saunders field. The well blew out and burned in September while showing for discovery production from the Wolfcamp. Total depth was 12,172 ft.

Rowan Oil Co. has made location for 1 Simmons-Federal, a 12,000-ft. Devonian exploration in 8-10s-38e, northeast Lea County.

Humble Oil & Refining Co. will drill 1 State "AC" as a 11,000-ft. test on the northeast edge of shallow Vacuum field.

Sun Oil Co. 1 Harper-Federal cored 20½ ft. of black shale, bleeding gas, from 12,013-33 ft.

Wilson Oil Co. 1 Amerada-State "B," north of the Maljamar area in 27-16s-32e, was reaming hole at 3,710 ft. It will be drilled to 10,500 ft., from old total depth of 4,915 ft.

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Mississippi

Adams County Wilcox Discovery Completed

JACKSON.—In southwestern Adams County, Mississippi, Humble Oil & Refining Co. has completed D-1 N. H. Breaux et al, Section 10-4n-4w, for what appears to be an extension of Fairview field of Concordia Parish, Louisiana. Completion was from perforations 6,710-20 ft. opposite Wilcox sand. On 6-hour test, the well flowed at the rate of 266 bbl. of 46.1°-gravity oil per day through ¼-in. choke with tubing pressure 270 psi. and casing pressure 50 psi. It will be recalled that this well had a total of 100 gross feet of saturated Wilcox sand in 7 zones. Completion perforations are opposite the top 10 ft. of the thickest zone.

Carter Oil Co. is at a depth of 5,002 ft. and is preparing to run drill-stem test at 1 Mattie B. McFadden et al, Section 36-16s-5e, in Clay County, Mississippi. While drilling from 4,978 to 4,986 ft., cuttings showed very fine-grained sand with 100 per cent fluorescence. Core was then cut 4,986-5,000 ft. recovering 15 ft. of shale which was silty and sandy with fluorescence and oil odor. Drill-stem test will be run on interval 4,978-5,002 ft.

With flow of 360 bbl. of oil per day through 9/64-in. choke, John S. Callon, independent operator of Natchez, has completed 1 Mrs. May Field Hodges, Section 10-6n-4w, in Adams County, Mississippi, for new Wilcox discovery. Tubing pressure was 625 psi. and gravity of oil 40.5°. Production is from casing perforations 6,200-04 ft. opposite top of a 14-ft. oil sand body logged in the Wilcox formation at 6,200-14 ft. Sidewall samples taken at 1-ft. intervals through the zone recovered clean, permeable sand before casing was set. Drill site of the new discovery is approximately 3 miles west of Butler Lake.

Barnett Serio and R. J. Bartlett are preparing to rig up pumping unit at their new Wilcox discovery in Franklin County, Mississippi. Operators' 1 Hattie G. Bauer, Section 30-5n-1e, was perforated shaly sand section 6,355-60 ft. Well was swabbed for approximately 8 hours and kicked off flowing by heads. Maximum top pressuret was 75 psi. and operators decided to install pumping unit before conducting further tests.

MISSISSIPPI SUCCESSFUL WILDCAT

Adams County: Humble Oil & Refining Co. D-1 N. H. Breaux et al, Sec. 10-4n-4w, TD 7,300 ft., IP flowed 266 bbl. of oil per day, ¼-in. choke, 46°-gravity oil.

MISSISSIPPI WILDCAT FAILURES

Covington County: U. B. Hughes-Smith Co. Oil Co. 1 J. A. Pickering, Sec. 22-8n-15w, dry, TD 5,017 ft.

Hinds County: Stanolind Oil & Gas Co. 1 Homer L. Cox, Sec. 24-6n-1w, dry, TD 10,730 ft.

Lincoln County: Gulf Refining Co. 1 US.A., Sec. 23-8n-5e, dry, TD 3,131 ft.

Union County: Harry L. Cullet 1-A L. R. Nabors, Sec. 36-7s-7e, dry, TD 2,740 ft.

Warren County: F. A. Callery 1 T. B. Henry, Sec. 8-7n-4w, dry, TD 10,475 ft.

Wayne County: Southeastern Drilling Co. 2 N. V. McRae Est. Sec. 6-8n-5w, dry, TD 11,022 ft.

Wilkinson County: Gulf Refining Co. 23 Crosby Lumber Co., Sec. 30-4n-2w, dry, TD 7,230 ft.

ALABAMA WILDCAT FAILURES

Baldwin County: Baldwin Oil & Development Co. 2 Dr. Amos Garrett, Sec. 9-9s-5e, dry, TD 8,008 ft.

Henry County: Southeastern Operators Committee 1 Gamble, Sec. 13-4n-28e, dry, TD 6,394 ft.

FLORIDA WILDCAT FAILURE

Santa Rosa County: E. D. Scruggs-L. Cashion Co. 1 H. Hanna, Sec. 29-6n-29w, dry, TD 6,722 ft.

Appalachian-Ohio

New Oriskany Gas Field Opened in Pennsylvania Area

COUDERSPORT, Pa.—Highlights of recent developments is the discovery of a new Oriskany sand gas field in Benezette Township, Elk County. Keta Gas & Oil Co. 1 Charleroi Mountain Club has an open flow of 2,300,000 cu. ft. from the Oriskany sand. Rock pressure is reported as being 3,810 psi.

This discovery is located 8 miles southwest of Driftwood gas field. The Oriskany sand top is 6,943 ft. and gas was encountered at 6,945 ft. (well-head elev. 2,055 ft.). Operators are drilling ahead in hopes of finding another producing zone in the Oriskany.

Included among other recent significant developments was the completion of Keta 1 State of Pennsylvania (Tract 20). This well, which extended Driftwood field ¾ mile southwest, resulted in an open flow of 4,800,000 cu. ft. of gas from the Oriskany sand at a depth of 5,927 ft. (well-head elev. 937 ft.). Rock pressure was 3,800 psi.

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Keta has abandoned its 1 State of Pennsylvania (Tract D). This wildcat test, located in Gibson Township, Cameron County, topped the Oriskany sand at a depth of 7,565 ft. and was drilled to a total depth of 7,594 ft. (well-head elev. 2,058 ft.). Drill-stem test gave no showing of gas, oil or salt water.

In Beech Creek Township, Clinton County, New York State Natural Gas Co. has completed its 2 State of Pennsylvania (Tract A) as a dry hole. The Oriskany sand was topped at 7,592 ft. and was core drilled. Total depth was 7,650 ft. plus (well-head elevation 2,056 ft.). This is the fourth dry hole drilled on the Laurel Hill anticline which has now been tested for a distance of 18 miles. Two other tests are currently drilling on this anticline. Both of these tests are located southwest of the above mentioned dry hole. Keta 1 City of Philadelphia is drilling black shale above the Oriskany at a depth of 8,100 ft. The 2 State of Pennsylvania (Tract E) of Manufacturers Light & Heat Co. is drilling at an unknown depth. Both tests are located in Burnside Township, Centre County.

Deep Rock Oil Co. has moved on to a location in Greene Township, Clinton County. This test, located east of the plateaus in the highly folded Appalachians, is scheduled to test sub-Devonian formations.

The California Co. 1 Byron Schnyder located in Pine Township, Lycoming County is fishing at a depth of 6,500 ft.

Maryland.—In Garrett County Eberly & Snee 1 Lichty, which reached a depth of 4,177 ft., and shut down, is fishing at 4,000 ft. Cumberland & Allegheny Gas Co. 1 Swartzengruber, after running 8-in. casing, is drilling at 2,049 ft.

West Virginia.—In Harvey District, Mingo County, E. C. Ware 1 Marcum gaged 1,704 M.c.f. of gas in the Brown shale, total depth 3,230 ft. Portland district, Preston County: Cumberland & Allegheny Gas Co. 1-477 Creamer, elevation 2,212 ft., is drilling at 5,448 ft.

PENNSYLVANIA WILDCAT FAILURES

Cameron County: Keta Oil & Gas Co. 1 State of Pennsylvania (Tract D), dry, TD 7,594 ft.

Clinton County: New York State Natural Gas Co. 2 State of Pennsylvania (Tract A), dry, TD 7,650 ft.

OHIO

A second shallow gasser increases the probability of a pool in the north part of Salem Township, Meigs County. Mealton and Perry 1 Ralph Turner, Section 23, topped the Maxburg 700 ft. at 500 ft., and at 5 ft. in gaged 270,000 cu. ft. natural. Several other wells are planned to further test the area.

The Hanover Township, Licking County, pool was extended a 1,000 ft. to the south by Waverly Oil 4 A. W. Howell, Lot 15. Clinton sand at 2,853-2,910 ft. made 125 bbl. in 24 hours after an 80-qt. shot.

W. E. Shrider et al 1 Donis Singer, 2nd Qr., New Castle Township, Coshocton County, an outside location to New Castle pool, found the Clinton sand at 3,133-85 ft. with a good showing of oil natural. After a 140-qt. shot, the oil increased to 90 bbl. in 24 hours.

Allen Willey 1 C. Ray Howell, Section 21, Jackson Township, Knox County, ½ mile east of production, logged the Clinton at 2,982-3,035 ft. with a fair showing of oil. The test was shot with 120 qts. and made 65 bbl. in 24 hours.

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Kansas

New Gas-Producing Area Opened in Meade County

ANOTHER gas-producing area has been opened in southwestern Kansas along the east side of the Hugoton gas field with the completion by Delhi Oil Corp. of its 1 Easterday, C SW NE 23-34s-26w, 2 miles east of Lakeland, in southeastern Meade County. Producing from Morrow sand (basal Pennsylvanian), opposite which casing is perforated at 5,857-90 ft., the well has a rated open-flow potential of 9,500,000 cu. ft. of gas per day. Total depth is 5,952 ft. in the Mississippian, topped at 5,900 ft. Top of the Morrow was called at 5,845 ft. Location is 2½ miles south of the McKinney gas field.

On the west flank of the Hugoton gas field, in Morton County, Cities Service Oil Co. has completed an extension gas-producer at its 1-A Boehm, NE NE NW 11-33-42. The well, located north of the Greenwood gas area, and 6 miles west of Hugoton gas production, is rated good for 15,800,000 cu. ft. per day on open-flow potential. Pay is in the Permian with casing perforated at 2,988-3,159 ft. Hole had been drilled to 5,152 ft. in the St. Genevieve, topped at 5,094 ft.

W. E. Green's new Viola discovery well, 1 Brand, NE NE SE 16-29s-7w, 7 miles south of Gingman, in southern Kingman County, is being put on the pump following swabbing tests in which it produced at the rate of 20 bbl. of oil per hour natural. Pay is open through casing perforations at 4,511-14 ft.

(Continued on page 402)

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Wheeler Ridge Extensions' Outcome To Be Known Soon

LOS ANGELES.—Outcome of two extension attempts to the deep Eocene pool at Wheeler Ridge, southern Kern County, shortly will be known. At 356 Kern County Land, ¾-mile east of the discovery, Standard Oil Co. of California halted drilling at 11,304 ft. to set a 7-in. string of protection casing. It was anticipated Standard would make a thorough test of the extensioner's Eocene possibilities. About ¾ mile still further east in SE SW 27-11n-20w, Standard 237 K.C.L. was drilling ahead at 12,300 ft.

In NE SW 36-11n-21w, 2½ miles southwest of the discovery, Richfield Oil Corp. 1 San Emidio-B was nearing 5,000 ft. This test is in a highly faulted area, on an east-west trending anticlinal fold which is believed to extend from Wheeler Ridge through Pleito Creek in Section 35. Its progress thus was being closely watched.

In the Tejon area 6 miles east of Wheeler Ridge, Union Oil Co. was completing a seismic survey after having negotiated a deal with Reserve Oil & Gas Co. on about 5,000 acres of the latter's leasehold property. Aside from a few shallow holes the block, which lies west of Tejon Hills and north of Tejon Ranch production, is relatively untested. Union is expected to announce location of its first test about the first of the year.

Productive limits of Poso Creek field apparently were extended ¼ mile east by M. J. M. & M. Oil Co. et al 1 U.S.L.-Snow. Located in SE NW 4-28s-27e, the well topped a 46-ft. upper Miocene oil sand at 2,395 ft. It was being completed on the pump through perforations at 2,390-2,500 ft.

A new San Joaquin Valley wildcat was Atlas Oil Co. et al 1 Neufeld Community, about 1½ miles southeast of Rosedale field. The wildcat, located in SW 19-29s-27e, was drilling below 2,700 ft. toward the lower Stevens goal at abt at 7,500 ft. Site is less than 1 mile north of Standard 48 Shellabarger, abandoned at 7,600 ft. last June. About 1 mile south of Sharktooth production, A. J. McGreery, operator, was preparing to spud 1 McGregor in SE 26-28s-28e.

At the new Careaga field in Santa Barbara County, Coastal California, Western Gulf Oil Co. completed 2 Careaga as a ¾-mile northeast extension to the discovery. The wildcat pumped 72 bbl. net of 24-gravity crude through perforations between 4,522-4,975 ft.

The Texas Co. has staked a new wildcat east of Richfield in Orange County. The test, 1 Travis, will be in 30-3s-8w, or about 1 mile northeast of Richfield's Kraemer production.

CALIFORNIA SUCCESSFUL WILDCAT

San Luis Obispo County, new pool discovery ¾ mile west of Midway-Sunset field: Oceanic Oil Co. B-1-2 C.C.M.D., SE NE 2-32n-22e, pumped 115 bbl. per day from perforations at 2,081-2,222 ft., 15.2° gravity, 1.2 per cent cut. TD 2,223 ft., elev. 1,638 ft.

CALIFORNIA WILDCAT FAILURES

Fresno County, Cheney Ranch area: E. A. Bender 1 Chaunet, 1-14s-12e, dry, TD 3,511 ft., elev. 525 ft.

Kern County, Los Lobos area: Richfield Oil

Corp. 81-29 San Emidio A, 29-11n-22w, dry, TD 8,659 ft., elev. 956 ft.

Cummings Valley area: Daniel Amfitheatrol & associates 1 Shomehen, 26-32s-31e, dry, TD 500 ft., elev. 3,877 ft.

Edison area: P. A. Doheny 2 Di Giorgio, 3-31s-29e, dry, Permeable Sta. Margarita 4,915 ft., Schist 5,030 ft.

Monterey County, Biaggi area: Monterey Oil Co. 2 Western, 3-22s-9e, dry, TD 1,380 ft., elev. 724 ft.

Orange County, Olinda area: Shell Oil Co. 100 Olinda Fee 1, 9-3s-9w, dry, TD 5,825 ft., elev. 518.

San Benito County, Hollister area: Monterey Oil & Gas Exploration Co. 1 Grant, dry, TD 1,480 ft., elev. 226 ft.

San Benardino County, Chinco Hills area: E. J. Champion 1 Champion, 5-3s-8w, dry, TD 1,700 ft.

Rocky Mountain

Testing Continues at Important Montana Tests

DENVER.—While tests continue at several important wildcats in the eastern Montana portion of the Williston basin, new shows have been logged in at least one additional important test of the relatively undrilled area.

Slight shows cored from formation tentatively identified as Charles at Sun Oil Co. and Phillips Petroleum Co.'s joint wildcat 1 Dynneson, C SW NE 32-24n-58e, Richland County, northwest of the town of Sidney, Montana, were latest additions to the list of unanswered questions now hinging on outcome of tests at several wildcats in this portion of the basin. The Sun-Phillips wildcat had recovery of slightly stained core with faint odor from the interval 8,757-72 ft. Top of Charles was not announced, but top of Otter was logged at 7,920 ft. The operators are coring ahead on the wildcat, which was scheduled as a 13,000-ft. test to Ordovician on a block of several thousand acres assembled for the first drilling in this area in the current Williston basin play.

Forthcoming tests at Los Nietos-Hancock Oil Co.-Signal Oil Co. 1 Nuhring, C NW NE 32-35n-47e, Daniels County, hold the answer to this northernmost show within the Montana part of the basin. The well was bottomed at 9,272 ft., plugged back to 7,580 ft. for test of shows in Devonian which were logged during drilling. Casing was landed at 7,365 ft. and perforated 7,284-7,309 ft. and operator is preparing to swab. This interval made 100 ft. of gas-cut mud with slight oil show at bottom on drill-stem test. Shows were also logged uphole, in Mississippian formations. The wildcat is in an area where several major companies hold extensive acreage and a commercial success would be responsible for a considerable drilling program through the area.

Southwest of the Daniels County wildcat, Continental Oil Co. has swabbed 56 bbl. of oil and 140 of salt water from the 1 Fast, C NE SE 14-30n-46e, in the West Poplar area of Roosevelt County after acidizing. Swab gage was of 19 hours duration, and was from perforations 6,409-25 ft. The operator is continuing to perforate and test selectively in the wildcat which flowed an estimated 20 bbl. of oil per hour on drill-stem test.

Also in the West Poplar area Ajax Oil Co. of Billings has released information on one of its two wildcats in the area. The company reported a flow of 121 bbl. of oil and 10 of water in 24 hours from 1 McDonald, C NW NW 15-29n-50e. Production is from the interval 6,172-80 ft., with total depth 6,180 ft. Tops were not released. No data were made public from 1 McGowan, C SE SW 10-29n-50e, which was unofficially reported as swabbing 6 bbl. of oil per hour several months ago.

In eastern Roosevelt County, Deep Rock Oil Co. has swabbed at the rate of 6 gal. of oil and 21 bbl. of water per hour from 1 Picard, C NW NE 6-29n-58e. Tested interval is 8,745-98 ft. Water broke in during the test, and the operator is preparing to reperforate and continue testing.

Zack Brooks-Crawford Smith are preparing to install pump at the 1 Berentson, C SW SE 21-163n-80w, Bottineau County, North Dakota, after the well swabbed at the rate of 2 bbl. of oil and a like quantity of mud and acid water per hour from the interval 3,352-85 ft. Test followed acidization with 2,500 gal. Top of Charles was 3,337 ft.

Sohio Petroleum Co. has run casing for test of Phosphoria and Tensleep shows at 1 Government, C NE SW 27-31n-95w, in the Beaver Rim area of Fremont County, between Sand Draw and Happy Springs fields.

In the Denver-Julesburg basin new locations again numbered 12, with the majority of these in western Nebraska. In the West Sidney area of Cheyenne County, Nebraska, Ohio Oil Co. had two gas discoveries completed, with gage of 7,500 M.c.f. per day tested at 1 Witters, NE NE SE 18-13n-50w, and 3,500 M.c.f. per day from 1 Chambers, NW SE SE 14-13n-51w. Both wells produce from "D" sand at about 4,800 ft.

Cities Service Oil Co. staked location for a central Utah wildcat in C NE NW 1-16s-12e, in the Grassy Creek area of Emery County, an area which has had little recent

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THE OIL AND GAS JOURNAL

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activity. The wildcat will test Pennsylvanian, at about 7,000 ft.

One of three operations in Idaho has been plugged. Standard Oil Co. of California abandoned the 1 Unit, C NE NE 32-7s-44e, in the Dry Valley area of Caribou County at 7,868 ft. without reported shows. Tops have not been released on the wildcat, one of two being drilled in the state by this operator.

COLORADO WILDCAT FAILURES

Washington County: Hanco Oil Co. 1 Raines, NE NW NW 33-5s-54w, dry, TD 5,208 ft.

Kewanee Oil Co. 1 Morris, NE NE SW 7-5s-51w, dry, TD 4,433 ft.

Weld County: LaGloria Corp. 1 State, NW NW NW 4-2n-61w, dry, TD 7,016 ft.

WYOMING SUCCESSFUL WILDCATS

Park County: Resolute Oil Co. 6 NPRR, C NE NE 17-57n-101w, Badger Basin, pumped 20 bbl. of oil from Dakota per day, new pay discovery, TD 9,870 ft.

Sweetwater County: Mountain Fuel Supply 1 Unit, NE NE SE 9-13n-100w, Trail Unit, flowed 4,260 M.c.f. of gas per day from Mesaverde, TD 7,731 ft., PBTD 7,568 ft.

WYOMING WILDCAT FAILURES

Carbon County: Continental Oil Co. 1 Unit, SE NE SW 10-16n-84w, dry, TD 1,610 ft.

J. G. Dyer et al 1 Government unit, CE½ E½ NE 17-25n-86w, dry, TD 6,288 ft.

Fremont County: Continental Oil Co. 1 Tribal, NW NW NW 4-6n-2w (WRM), dry, TD 3,011 ft.

Johnson County: The Texas Co. 1 Mayoworth unit, SW SW SE 13-44n-82w, dry, TD 7,099 ft.

Laramie County: Pure Oil Co. 1 Hixenbaugh, SE SW NE 34-16n-61w, dry, TD 8,108 ft.

Natrona County: Atlantic Refining Co. 3 Unit, SE NE NW 9-31n-84w, pumped ⅔ bbl. of oil per day, suspended, TD 1,553 ft.

Park County: Fremont Petroleum 1 Moyer, SW NE NW 31-52n-101w, dry, TD 1,474 ft.

MONTANA SUCCESSFUL WILDCAT

McCone County: Shell Oil Co. 21-33-B-NP, C NE NW 33-22n-48e, flowed 177 bbl. of oil per day through 7/64-in. choke, Devonian discovery, new field, SW Richey, TD 9,260 ft.

MONTANA WILDCAT FAILURES

Big Horn County: Gill Cattle Co. 1 Hardy, NE SW NE 22-9s-35e, dry, TD 1,706 ft.

Carbon County: Cities Service Oil Co. 1 Earl M. Smith, SE SE NW 23-9s-24e, dry, TD 5,680 ft.

Fergus County: B&L Drilling Co. 2 N-Bar, NE SW NE 8-12n-24e, dry, TD 1,695 ft.

UTAH SUCCESSFUL WILDCATS

Duchesne County: Carter Oil Co. 1 Joseph Smith, C SE SE 16-3s-5w (USM) Flat Mesa, flowed 273 bbl. of oil per day through ¼-in. choke, Green River discovery, TD 9,103 ft., PBTD 8,864 ft.

Uintah County: Carter Oil Co. 1 Orlan L. Johnson, SW SW 8-7s-24e, Walker Hollow, pumped 189 bbl. of oil per day from Green River, TD 5,716 ft.

SOUTH DAKOTA WILDCAT FAILURES

Faulk County: N. B. Hunt and Lakota Oil Co. 1 Gutenbauf, C NE NE 20-118n-72w, dry, TD 2,749 ft.

Hyde County: N. B. Hunt and Lakota Oil Co. 3 State, C SW NW 31-116n-73w, dry, TD 2,715 ft.

Sully County: N. B. Hunt and Lakota Oil Co. 2 Lakota, CEL SE NE 24-116n-73w, dry, TD 2,618 ft.

NEBRASKA SUCCESSFUL WILDCATS

Cheyenne County: Ohio Oil Co. 1 Witters, NE NE SE 18-13n-50w, West Sidney area, flowed 7,500 M.c.f. of gas per day from "D" sand, TD 5,049 ft.

Ohio Oil Co. 1 Chambers, NW SE SE 14-13n-51w, West Sidney, flowed 3,500 M.c.f. of gas per day from "D" sand, TD 5,094 ft.

NEBRASKA WILDCAT FAILURES

Cheyenne County: Service Drilling Co. 1 Goransun, SW SW SW 24-16n-51w, dry, TD 5,121 ft.

Kimball County: Rogers Oil Co. 1 Small, SE SE NE 33-14n-56w, dry, TD 6,666 ft.

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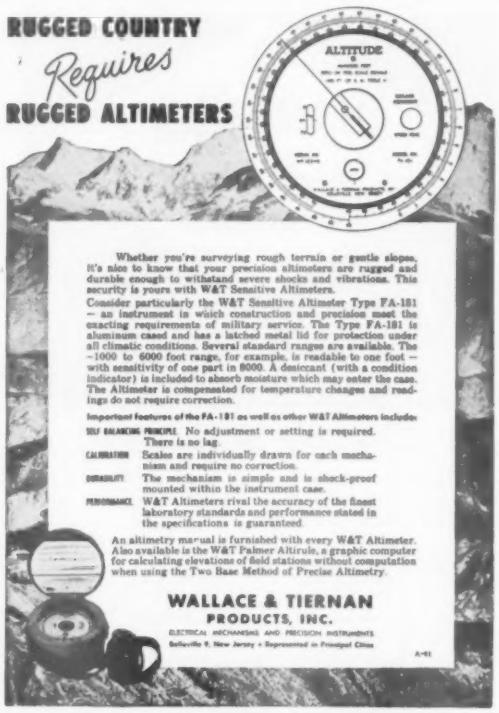

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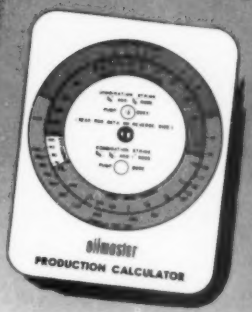

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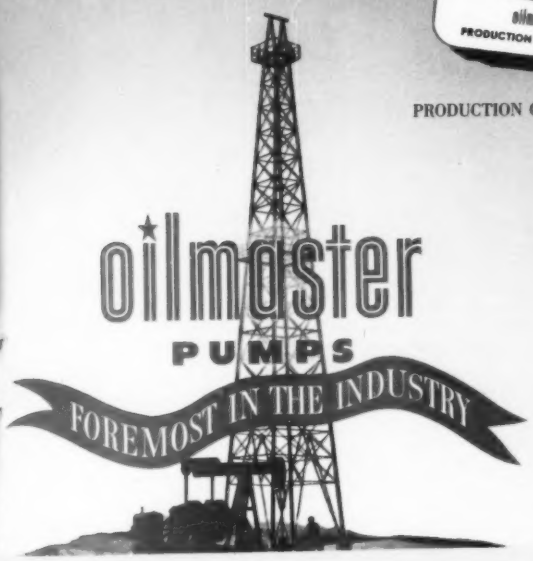

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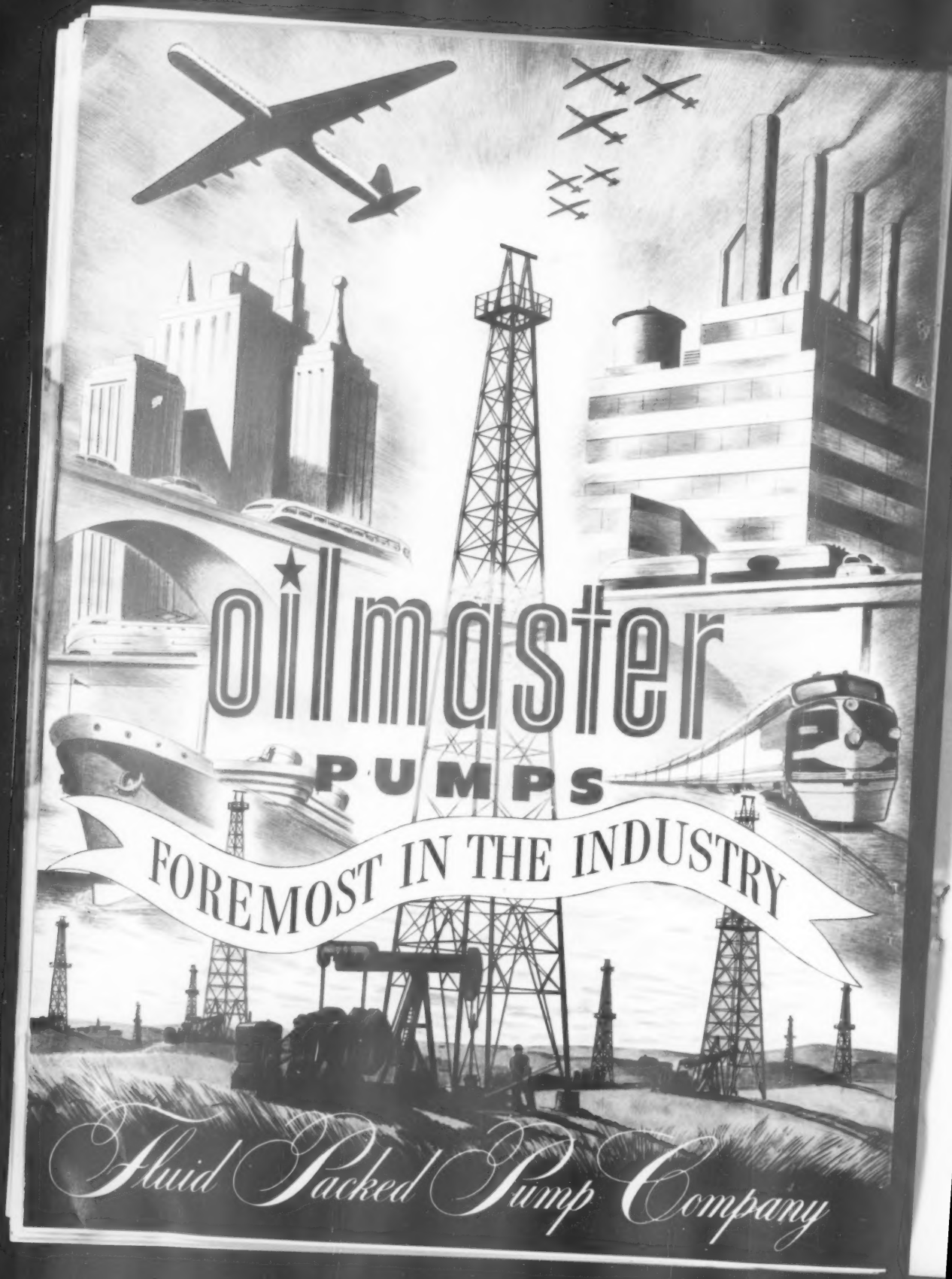
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Central Area

ILLINOIS

Lawrence County is getting a new Benoist-producing area located 4 miles southwest of Bridgeport and about 1¼ miles west of nearest production in the Lawrence field. The discovery well, Moss & Wilson 1 Harold Neal, NE SE NE 23-3n-13w, swabbed at the rate of 12 bbl. of oil per hour while cleaning out after operators fractured the formation. Pay is open through casing perforations at 2,048-62 ft. Total depth is 2,125 ft.

Testing also is under way at a new discovery well in Wayne County. The well is Misener Drilling Co. 1 Reid (minerals), SE SW NE 12-1n-8e, 2 miles northwest of Mount Erie and a mile from production in the Clay City Consolidated field. Indicated pay is O'Hara lime, in which a 60-minute drill-stem test at 3,126-33 ft. flowed gas in 5 minutes and clean oil in 55 minutes, and recovered 600 ft. of oil in the breakdown. Casing, run to bottom at 3,185 ft., is perforated opposite that interval.

Calvert Drilling, Inc., and Buffalo Oil Co. have an indicated McClosky producer at their 1 Bachman, SW SW NW 1-6s-9e, ½ mile west of production in the Storms area, 4 miles south of Carmi, White County. Oil string is being run following two drill-stem tests, the first, at 3,100-16 ft., getting gas in 5 minutes and recovering 510 ft. of oil and 170 ft. of water, and the second, at 3,138-53 ft., getting gas in 10 minutes and recovering 629 ft. of oil with only 2 ft. of water.

First production from Warsaw lime in Richland County is being established by Don Slape and W. H. Bears at their 1 Wasson, NW SE SW 27-4n-9e, 5½ miles northwest of Olney in the Clay City Consolidated field. Swabbing tests of the pay in open hole at 3,637-48 ft. produced 4½ bbl. of oil and 2 bbl. of water per hour natural. Hole is plugged back from 3,653 ft., original total depth.

Q. B. Mitchell 1-B Harrelson, NE NE SE 31-6s-5e, west outpost test for the Cantrell North pool, in southwestern Hamilton County, swabbed at the rate of 100 bbl. of oil per day while testing its Aux Vases pay at 3,249-60 ft.

INDIANA

Illinois Mid-Continent Co. has run casing to test good oil showings found in O'Hara lime at its 1 Haper, NW NE NW 33-1s-10w, a wildcat located east of the Patoka East pool, in northern Gibson County. O'Hara was logged at 1,965-69 ft. A 75-minute drill-stem test at 1,965-69 ft. got gas in 2 minutes and filled 600 ft. of oil and 120 ft. of oil-cut mud. Since that test, hole has been deepened to 2,037 ft. in McClosky lime, which tested sulfur water.

About ¾ mile to the northeast of the Illinois Mid-Continent well, F. L. Beard has an indicated dual-zone producer at his 1 State-Kolb, NW SW NE 28-1s-10w. The well swabbed 1½ bbl. of oil per hour natural from O'Hara lime at 1,845-55 ft. Deepened to 1,893 ft. in Rosiclare lime, with saturation from 1,890 ft., it flowed at the rate of 20 bbl. of oil per hour.

WESTERN KENTUCKY

A new-pay and extension discovery has been made in the area a mile southeast of Dixon, in Webster County, where E. G. Burke, Sr., is testing Hardinsburg sand at his 1 Jackson heirs, SE SE NW 25-M-23. The new well, located 1,500 ft. east of a small O'Hara discovery well, completed in December 1950, recovered 400 ft. of clean oil and 45 ft. of oil-cut mud in a 60-minute drill-stem test

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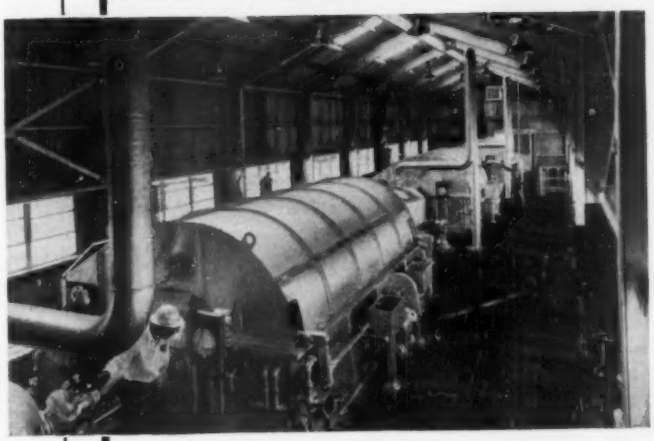

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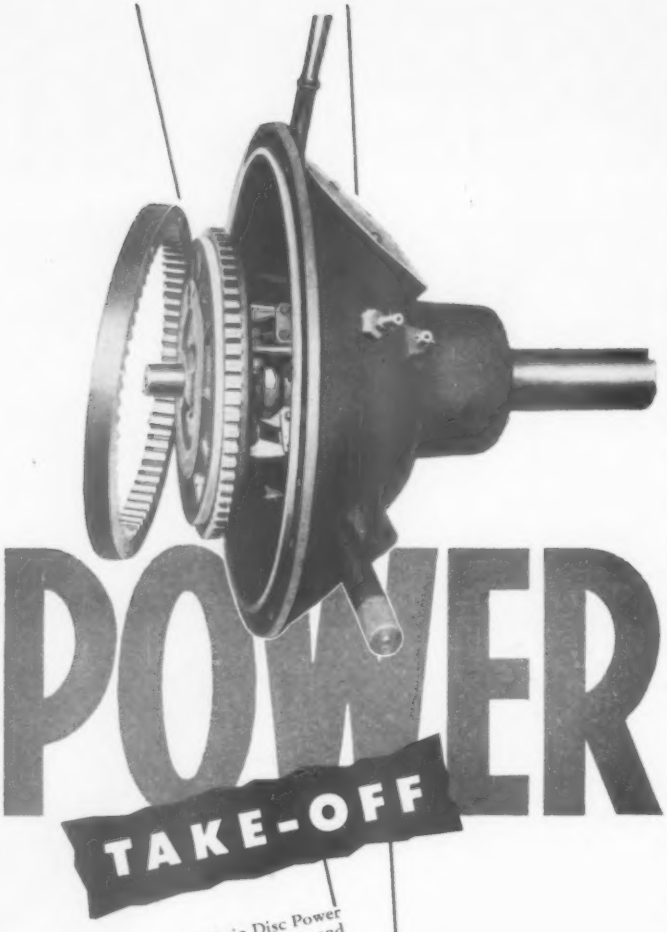

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of the Hardinsburg sturation, logged at 2,665-2,709 ft. No water was indicated. Since then hole has been deepened to 2,719 ft. and casing run to the top of the pay. The O'Hara discovery well, with pay at 3,109-13 ft. now is pumping around 6 bbl. of oil per day. It pumped initially around 50 bbl. per day.

EASTERN KENTUCKY

In the Knott County sector of Big Sandy gas field, Kentucky West Virginia Gas Co. have completed 5,941 Lizzie King for an open flow potential of 381,000 cu. ft. of gas daily. Production is from the Devonian black shale at a total depth of 3,245 ft.

Letcher County which was recently added to the list of gas producing counties in Big Sandy gas field has two more tests drilling or about to start. Kentucky West Virginia Gas Co. 6093 L. D. Collins is drilling at 1,910 ft. in slate and shells and same companies' 6103 W. R. Polly is completing road to location. The Polly test is on same lease which opened production in Letcher County, the original well making 292,000 cu. ft. of gas daily from the Mississippian Big lime.

MICHIGAN

Acidized with 190 gal. in the Dundee, The Moco 1 Ortwein, SW NW NE 7-14-7w, Wheatland Township, Mecosta County, flowed 80 bbl. of net oil first 3½ hours, but production was chocked back to 20 bbl. a day as a precaution to keep water from showing. No water was showing, according to last report, however. Well pumped and flowed from 12 to 20 bbl. a day natural. Dundee top was logged 3,675 ft., with pay showing from 3,677-78 ft., total depth. The Moco 1 Ortwein is the direct west 10-acre offset to a 1945 Dundee discovery, now abandoned, which was drilled by Smith Petroleum Co. Following Smith's success, dry holes were drilled in every direction from this older well but to the west. Additional drilling on Moco's 1,100 acre block which lies mostly to the west, is expected early in 1953.

First attempts to confirm and expand the Greenwood Township field, Clare County, have met with two failures in the Dundee at the north and south offsets to Lud Segerlund 1 Caner et al, NE NE NE 11-19n-5w, the small 14 bbl. discovery well. Same operator's 1 Kuehl, NE SE NE 11-19n-5w, the south offset, was deepened from the dry Dundee to the Richfield where it was also unsuccessful. Well was bottomed out dry at 5,432 feet, 5 feet below the Richfield in the black lime. The Segerlund 1 Butt, SW SE SE 2-19n-5w the diagonal northwest 20-acre offset to the 1 Caner, logged Dundee at 4,036 ft., a limestone top, about 3 ft. lower on this objective than the discovery, and dolomite porosity was not logged until about 4,036 ft. Water showed on drill-stem test, but one or more cores in the Dundee were scheduled to be cut. This offset, if dry following additional coring and testing, is scheduled to be completed as a brine disposal well.

ILLINOIS SUCCESSFUL WILDCATS

Wabash County: W. L. Griffith and Jack Hirsch 1 Pixley heirs, NE NW SW 24-1n-14w, IP 100 bbl., O'Hara 2,850-54 ft., TD 2,854 ft.

J. F. Hinkle 1 Berberick, SE SE NE 19-1s-13w, IP 15 bbl., Cypress 2,523-40 ft., TD 2,939 ft.

ILLINOIS WILDCAT FAILURES

Bond County: T. M. Conrey 2 Kaiser, NW SW SE 32-4n-3w, dry, TD 1,286 ft.

Clay County: Calvert Drilling, Inc., 1 Clark heirs, NE SW NW 4-2n-7e, dry, TD 3,135 ft.

(Continued on page 402)

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MANUFACTURERS
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CONSULTANTS
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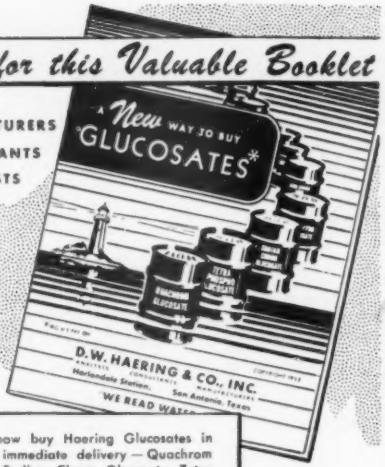
ANALYSTS



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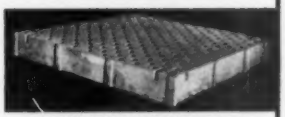

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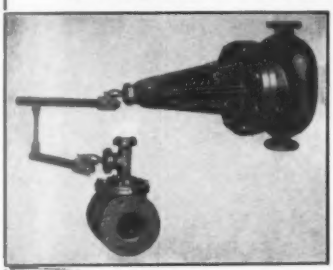

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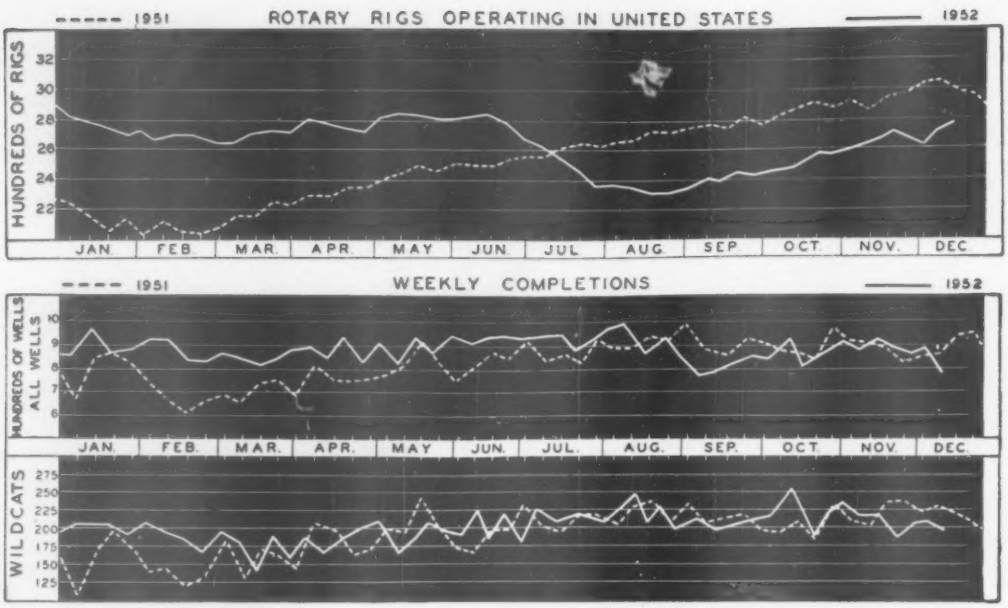


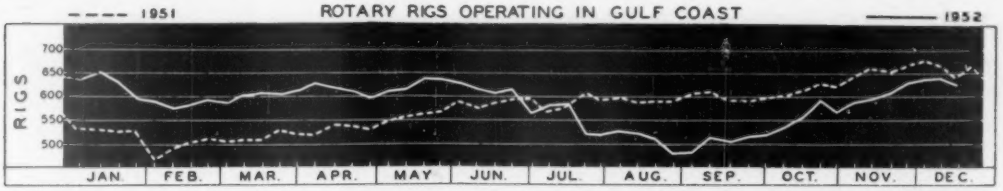
CURRENT STATISTICS

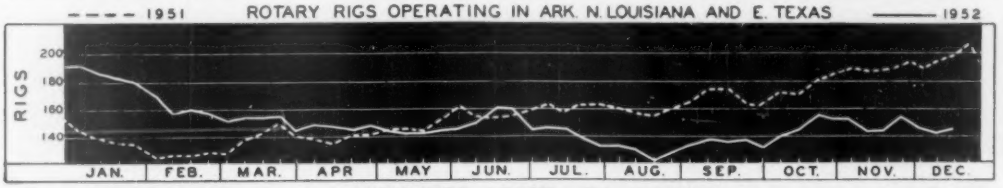
EXPLORATION

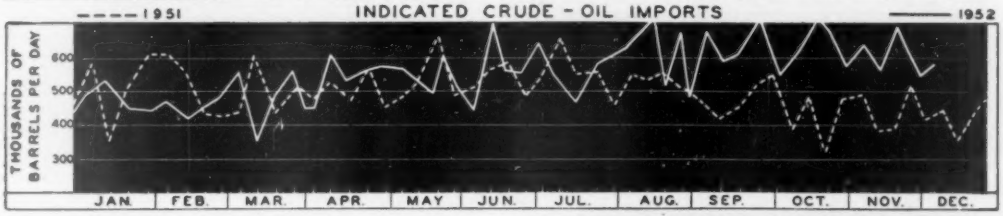
WEEKLY WELL COMPLETIONS . . . WEEK ENDED DECEMBER 13, 1952

	Total of all wells							Wildcat completions and discoveries									
						Dec. 13							Cumulative total, 1952				
	Comp.	Oil	Gas	Dry	Footage	1952	1951	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	14	7	0	*7	22,550	743	618	0	0	0	0	0	0	0	0	2	2
Pennsylvania	39	19	5	†15	86,378	1,908	1,668	0	0	1	2	3	0	0	1	4	5
West Virginia	13	1	11	1	28,419	596	599	0	0	0	0	0	0	0	4	9	13
Ohio	25	10	4	‡11	55,726	985	929	0	0	0	0	0	2	0	8	17	27
Indiana	32	11	1	20	53,912	1,223	1,338	1	0	1	10	12	35	0	4	356	395
Kentucky	19	6	1	12	32,963	1,249	1,265	1	0	0	3	4	25	0	1	258	284
Illinois	40	11	0	29	113,121	2,009	2,370	2	0	0	12	14	29	0	1	552	582
Michigan	9	4	0	5	31,140	674	727	0	0	0	4	4	24	0	5	233	262
Kansas	85	32	10	43	295,563	4,369	4,257	0	0	0	16	16	91	0	15	711	817
Nebraska	4	0	2	2	21,930	295	224	0	0	2	2	4	12	0	5	159	176
Oklahoma	90	48	9	§33	321,481	5,570	5,385	1	0	0	14	15	101	4	12	581	698
Texas	242	111	25	106	1,323,299	16,122	15,966	7	0	2	65	74	744	50	121	3,709	4,624
North Central (Dist. 7-B & 9)	68	27	1	40	238,260	5,144	4,850	2	0	0	23	25	412	2	25	1,504	1,943
West (Dist. 7-C & 8)	47	33	0	14	325,095	4,772	4,869	4	0	0	11	15	163	1	9	678	851
Panhandle (Dist. 10)	10	1	6	3	23,176	607	694	0	0	0	2	2	4	0	8	62	74
Eastern (Dist. 5 & 6)	14	6	3	5	87,404	841	1,131	0	0	0	2	2	20	5	4	222	251
Gulf Coast (Dist. 2 & 3)	60	28	10	22	413,148	2,478	2,203	1	0	0	11	12	72	29	33	558	692
Southwest (Dist. 1 & 4)	43	16	5	22	236,216	2,280	2,219	0	0	2	16	18	73	13	42	685	813
Louisiana	44	28	5	11	285,451	2,259	2,133	0	0	1	2	3	39	18	16	313	386
Northern	23	16	3	4	66,971	1,240	1,189	0	0	0	1	1	16	0	7	167	190
Southern	21	12	2	7	218,480	1,019	944	0	0	1	1	2	23	18	9	146	196
Arkansas	7	3	0	4	29,568	396	410	0	0	0	3	3	10	0	0	81	91
Mississippi	12	2	0	10	84,555	329	364	1	0	0	7	8	22	2	1	151	176
Southeastern States	5	1	0	4	33,590	72	50	0	0	0	3	3	3	0	1	37	41
Montana	13	6	0	7	58,550	341	243	1	0	0	3	4	10	0	1	87	98
Wyoming	16	7	1	8	85,297	677	696	1	0	1	7	9	22	0	5	143	170
Colorado-Utah	9	4	2	3	55,163	534	298	2	0	0	3	5	22	0	11	244	277
New Mexico	14	6	5	3	67,441	1,001	696	0	0	0	0	0	36	3	3	104	146
California	40	31	0	9	149,118	2,335	2,235	1	0	0	8	9	68	0	7	494	569
North Dakota	3	1	0	2	25,309	111	9	0	0	0	0	0	5	0	0	29	34
Miscellaneous (S. D.)	3	0	0	3	8,082	67	105	0	0	0	3	3	0	0	22	33	55
Total United States	778	349	81	348	3,268,606	43,865	42,585	18	0	8	167	193	1,300	77	244	8,307	9,928
Total previous week	891	438	62	391	3,797,334			19	1	6	182	208	1,282	77	236	8,140	9,735
Total December 15, 1951	945	524	49	372	3,839,826			28	2	4	185	219	1,508	76	251	8,157	9,992

Service wells included: *7, †12, ‡2, §3.





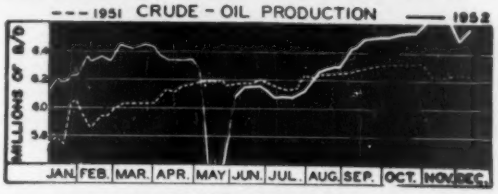


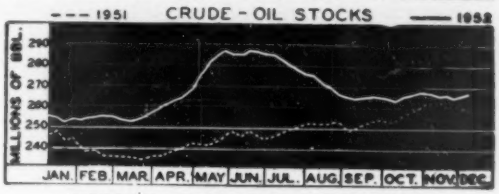
DAILY AVERAGE PRODUCTION FOR WEEK

	December 13, 1952			Dec. 6
	Crude oil	Lease condensate	Total	total
Alabama	3,400		3,400	3,400
Arkansas	76,250	600	76,850	77,250
California	990,100		990,100	990,900
Colorado	86,400		86,400	88,700
Eastern	55,000		55,000	56,000
Florida	1,500		1,500	1,500
Illinois	166,500		166,500	171,600
Indiana	32,400		32,400	33,700
Kansas	317,500		317,500	226,200
Kentucky	30,700		30,700	30,800
Louisiana	650,250	31,900	682,150	682,400
North	110,250	2,400	112,650	112,900
South	540,000	29,500	569,500	569,500
Michigan	36,100		36,100	36,100
Mississippi	91,600	3,800	95,400	95,750
Montana	27,300		27,300	26,800
Nebraska	9,600		9,600	8,600
New Mexico	175,275	450	175,725	175,825
Oklahoma	537,800		537,800	539,200
Texas	2,966,725	46,800	3,013,525	3,013,525
Dist. 1	38,675	250	38,925	38,925
Dist. 2	170,250	4,700	174,950	174,950
Dist. 3	485,100	24,600	509,700	509,700
Dist. 4	268,350	5,800	274,150	274,150
Dist. 5	55,000	350	55,350	55,350
Dist. 6	134,075	4,500	138,575	138,575
E. Texas field	265,150		265,150	265,150
Dist. 7-B	118,300	100	118,400	118,400
Dist. 7-C	170,125	5,800	175,925	175,925
Dist. 8	991,100	325	991,425	991,425
Dist. 9	189,900	350	190,250	190,250
Dist. 10	80,700	25	80,725	80,725
Utah	5,100		5,100	5,800
Wyoming	215,600		215,600	197,400
North Dakota	10,500		10,500	9,700
Total U. S.	6,485,600	83,550	6,569,150	6,471,150
Change from previous week			up 98,000	
Canada	188,950		188,950	149,725

Total U. S. production January 1-December 13 2,169,912,525 bbl.
Same period last year (crude plus cond.) *2,139,962,400 bbl.

*28,503,050 bbl. condensate.



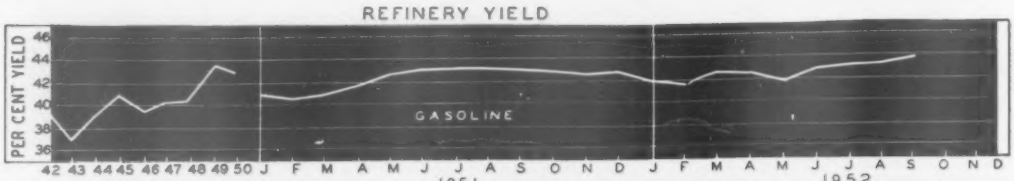


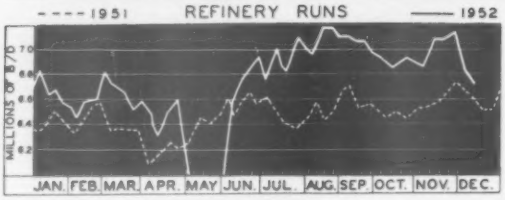
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

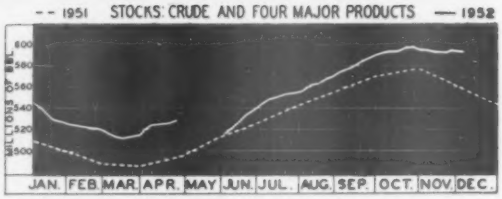
(Thousands of barrels)

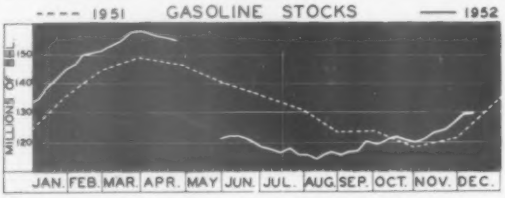
	Dec. 6, '52	Nov. 29, '52	Dec. 8, '51
Pennsylvania Grade	2,177	2,219	2,017
Other Appalachian	1,910	1,844	1,792
Illinois, Indiana, Michigan	11,395	12,071	12,283
Arkansas	3,252	3,264	2,634
Louisiana	16,618	16,303	13,899
North	2,441	2,382	2,824
Gulf	14,177	13,921	11,075
Mississippi	2,911	3,046	3,371
New Mexico	7,223	7,237	8,038
Oklahoma and Kansas	37,360	36,965	40,885
Texas	133,239	129,827	126,075
East Texas proper	11,669	11,721	(†)
West Texas	61,126	59,716	(†)
Texas Gulf	26,625	25,926	(†)
Other Texas	33,819	32,464	(†)
Rocky Mountain	14,648	14,668	13,721
California	30,283	30,643	28,782
Foreign	7,037	7,437	5,588
Total	268,053	265,524	259,085

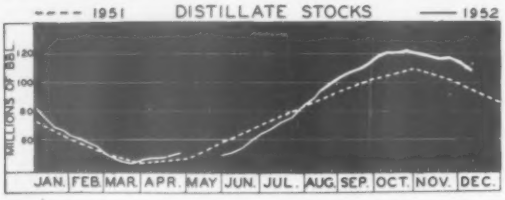
*Bureau of Mines. †Not comparable with current week.

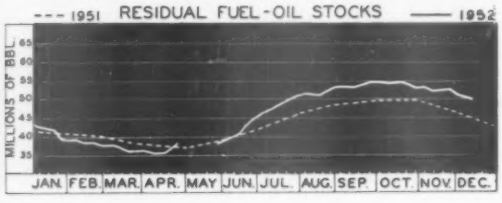










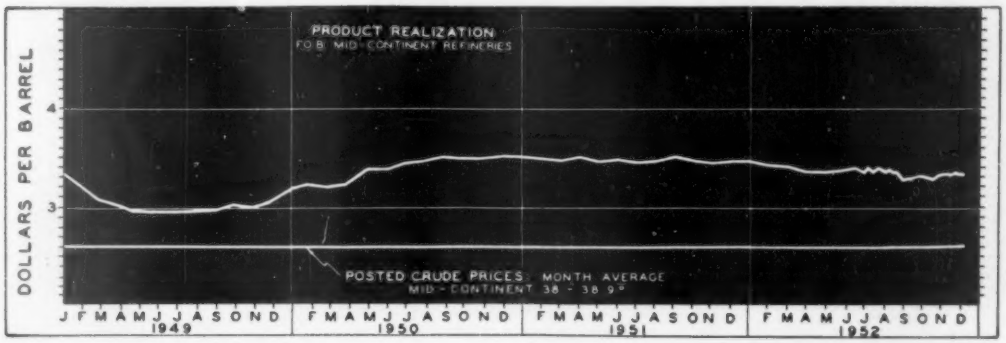


A.P.I. REFINERY REPORT, DECEMBER 13

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, December 1951—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,018	429.6	39.3	301.3	230.1	30,781	13,297	39,717	11,770	1,052	418.0	44.5	282.6	245.4
Appalachian:														
District 1	107	45.4	6.7	12.4	12.9	3,987	499	1,668	719	104	44.4	6.6	16.4	13.6
District 2	95	48.8	8.3	16.3	14.0	1,798	329	630	266	83	38.9	5.6	12.0	19.3
Ind., Ill., Ky.	1,223	651.1	94.4	227.3	185.4	27,046	6,258	19,775	5,554	1,253	643.6	81.4	234.6	188.9
Okla., Kans., Mo.	561	343.8	14.0	135.1	64.4	13,729	1,785	12,588	1,586	540	301.2	18.0	127.0	70.7
Inland Texas	238	171.6	11.7	39.7	38.9	5,201	445	2,240	1,019	244	173.1	16.6	37.5	41.2
Texas Gulf Coast	1,658	763.0	152.7	427.7	269.9	18,749	3,250	14,613	7,588	1,629	747.2	149.3	379.0	253.0
La. Gulf Coast	548	275.3	67.6	118.9	50.0	6,575	2,513	4,229	1,563	505	236.4	53.6	123.9	56.2
N. La. and Ark.	83	36.6	7.0	19.9	8.9	2,788	491	915	235	73	32.0	6.9	17.1	8.0
Rocky Mountain:														
New Mexico	17	10.9		3.0	3.7	163		64	47	17	10.5	0.7	2.4	3.9
Other Rocky Mtn.	243	119.0	8.0	49.9	46.4	4,195	382	1,918	947	217	102.8	5.4	48.6	52.6
California	924	408.3	11.9	149.8	358.0	14,570	386	11,318	18,587	929	401.4	4.0	160.6	359.9
Dec. 13, 1952	6,715	3,303.4	421.6	1,501.3	1,282.6	129,582	29,635	109,675	49,881	6,646	3,149.5	392.6	1,441.7	1,312.7
Dec. 6, 1952	6,809	3,359.7	413.4	1,459.4	1,255.0	129,470	31,142	114,362	50,658					
Dec. 15, 1951	6,553	3,182.3	360.4	1,467.1	1,251.9	125,375	30,564	97,870	44,967					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipe lines.


PRODUCT REALIZATION
F.O.B. MID-CONTINENT REFINERIES
DOLLARS PER BARREL
4
3
POSTED CRUDE PRICES: MONTH AVERAGE
MID-CONTINENT 38 - 38.9°
J F M A M J J A S O N D
1949
J F M A M J J A S O N D
1950
J F M A M J J A S O N D
1951
J F M A M J J A S O N D
1952

In this trend chart refinery realization is based on average Mid-Continent grade crude oil (not 38° gravity only) and average prices for refinery products as published in The Oil and Gas Journal basis Oklahoma (Group 3). Refinery yields confined to gasoline, kerosine, distillate and fuel oil. Realization averaged $3.33 for week ended December 6, $3.34 for previous week, and $3.48 for December 1951. The above trend information is based on volumes and current prices and therefore does not reflect changes in operating costs.

REPRESENTATIVE QUOTATIONS

Representative spot-market quotations of leading suppliers as of December 17, 1952. Figures are f.o.b. plant for tank-car shipments in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline, 80-82 octane	10⅜-10½	12.125-12.75	10¾-11
Premium gasoline, 86-88 octane	11⅜-11½	13.25-14.0	11¾-12
42-44 w.w. kerosine	8¾-9	10.5-10.65	9
No. 2 straw fuel oil	7⅝-8	9.65	8
No. 6 residual	$0.85-1.00	$2.10-2.20	$1.50-1.65

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	6⅞	6⅝	6⅝
Grade 18-55	8.25	7.75	8.0

LUBRICATING OILS
South Texas

200 vis., No. 2-3 neutral	13
750 vis., No. 3-4 neutral	16
2,000 No. 5-6 neutral	18-19

LUBRICATING OILS
Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	24-25
200 vis., No. 3 neutral, 0-10 pp.	13-14

Western Pennsylvania

145-155 vis., 10 p.t. bright stock	32.5
180 vis., 0 p.t. neutral	31.5

WAX
Mid-Continent

132-134 A.M.P.	5.5

THE residual market in the Mid-Continent tended to settle back to a sluggish pace at the start of the third week in December, following a slight flurry the previous week. The earlier interest in the residual market developed when several marketers in the Chicago area put out supply feelers in the Mid-Continent within a week.

Also, there was a drop of 1,743,000 bbl. in residual stocks for the country as a whole in the week ended December 6. Reductions for District 2 for the same week amounted to 467,000 bbl. Primary residual stocks in District 2 on December 6 were about 500,000 bbl. less than on corresponding date last year.

On the other hand, demand on the Mid-Continent refiners last winter to supply needs of the normal market for residual in the North Central states was so low that a large volume of surplus material moved to the Gulf Coast for export and shipment to East Coast markets. Mid-Continent refiners are expecting a much larger percentage of total residual production to move to normal northern markets this season, but some of them feel that it will take colder-than-normal weather to bring prices back to levels that were considered normal a year and a half ago.

Late in November, a New York marketer who bought part of the Mid-Continent residual that moved to the East Coast last winter said that he did not plan to buy any heavy fuel from inland refiners this year. Also, the willingness of East Coast residual suppliers to take on new customers this winter indicates that they expect enough product from normal sources to meet demands this winter. Spot rates for both American and foreign tankers were off slightly in the week ended December 13. Caribbean-to-East Coast rates dropped to MC minus 10 per cent from MC plus 5 per cent a week earlier.

CRUDE PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.‡	Oklahoma, Kansas	Gulf Coast Tex.*	West Tex.†
18-18.9	$1.93	....	....	
19-19.9	1.98	....	....	
20-20.9	2.03	$2.25	....	$2.12
21-21.9	2.07	2.27	....	2.14
22-22.9	2.12	2.29	....	2.16
23-23.9	2.18	2.31	....	2.18
24-24.9	2.24	2.33	$2.56	2.20
25-25.9	2.30	2.35	2.58	2.22
26-26.9	2.36	2.37	2.60	2.24
27-27.9	2.41	2.39	2.62	2.26
28-28.9	2.46	2.41	2.64	2.28
29-29.9	2.52	2.43	2.66	2.30
30-30.9	2.57	2.45	2.68	2.32
31-31.9	2.62	2.47	2.70	2.34
32-32.9	2.68	2.49	2.72	2.36
33-33.9		2.51	2.74	2.38
34-34.9		2.53	2.76	2.40
35-35.9		2.55	2.78	2.42
36-36.9		2.57	2.80	2.44
37-37.9		2.59	2.82	2.46
38-38.9		2.61	2.84	2.48
39-39.9		2.63	2.86	2.50
40 and above		2.65	2.88	2.52

*For crude from Daboval, El Campo, and Sand Point.

†Includes Lea County, New Mexico.

Last general price change represented a 50 cent increase, effective December 6, 1947.

‡Standard Oil Co. of California.

FLAT CRUDE PRICES

Representative posted schedules per barrel. Kettleman Hills, California*	$2.80
Louisiana:	
Beauregard Parish	2.60
Cotton Valley (distillate)	2.85
Cotton Valley (crude)	2.70
Texas:	
East Texas	2.65
Pecos County (Yates)	2.35
Conroe	2.83
Van	2.48
Pennsylvania Grade:	
Bradford	4.25
Southwest Pennsylvania	3.82
West Virginia	3.76
Illinois Basin	2.77

*37°-37.9°.

EQUIPMENT MEN . . . in the News

Beckman Appoints Fletcher Special Products Manager

T. FLETCHER

Arnold O. Beckman has announced the appointment of Taylor Fletcher as manager, special products division, Beckman Instruments, Inc. Fletcher replaces former manager, John F. Bishop, who was recently made assistant general manager of the company.

Fletcher received his bachelor of science degree in electrical engineering from California Institute of Technology in 1948. He completed graduate work in advanced meteorology, New York University. His former affiliations include that of design engineer for General Electric, Schenectady, N. Y., and electronic technician with Jet Propulsion Labs, Pasadena, Calif.

New Rust Control Ideas Featured in Color Film

Engineers, plant operating men, maintenance men, and contractors, will find new ways to stop corrosion and cut costs in the new Rust-Oleum Corp. full-color sound movie, "The Captain's Idea," just released.

This new 30-minute Rust-Oleum film includes a light-hearted, fast-moving plot and scenario with a complete cast of talent and filming on actual location. The entire movie is done in full color with synchronized sound. It is specially designed to reach and hold the interest of everyone in an audience—whether the gathering is general or specific in nature.

"The Captain's Idea" includes such highlight features as the new Rust-Oleum roller-coating method that saves up to 30 and 40 per cent on recoating wire fences and a special animation section illustrating how Rust-Oleum penetrates rust to bare metal incorporating the rust particles into the coating.

Sarosday Appointed Vice President, Engineering

L. J. SAROSDAY

Louis J. Sarosday has been appointed to the position of vice president, engineering, for J. B. Beaird Co., Shreveport, manufacturers of heavy steel products, according to a recent announcement by J. Pat Beaird, president and general manager.

Sarosday was formerly with Blaw-Knox Co. of Pittsburgh, where he was manager of engineering and sales of the company's steel forms department, and chief engineer of the construction equipment and machinery department.

The position occupied by Sarosday at Beaird is a new one, in which he will head up intensive development work now under way on new products, as well as on regular Beaird lines.

Nomads Meet in Chicago During A.P.I.

Members of Nomads gathered in the Crystal Ballroom of the Blackstone Hotel in Chicago during the recent A.P.I. convention for their annual meeting. Principal speaker was R. L. Dudley, Gulf Publishing Co.

Denison Engineering Co. Opens Houston Branch

DENISON NEALE

The Denison Engineering Co. of Columbus, Ohio, nationally known manufacturer of oil hydraulic equipment, recently opened a branch office in Houston to headquarter the company's southwestern sales, and service operations. W. C. Denison, president of the firm, has stated that rapidly increasing use of the company's popular line of HydrOILic equipment in oil-field operations has made this expansion necessary. The new branch is staffed by trained engineers and personnel from the Columbus plant.

Manager of the branch is Denison Neale, who has had broad experience in the engineering, design, and development of hydraulic equipment, with special emphasis on heavy industrial requirements. As a field engineer serving manufacturers in the Midwest, Neale encountered many specialized needs in the oil industry.

New Canadian Operations Announced by W. M. Barnes

John E. Ford, Jr., executive vice president of W. M. Barnes Co., Los Angeles, has announced the expansion of the company's operations, and the opening of W. M. Barnes Co. of Canada, Ltd., Toronto, to handle the company's increased activities in the petroleum and chemical industries in Canada.

For several years the Barnes organization has carried on construction work in Canada with the engineering and purchasing operations being conducted from Los Angeles. According to Ford, the new Canadian setup offers a threefold service to the petroleum and petrochemical industries; a complete service in process and mechanical engineering; purchasing, expediting, and inspection of materials, and construction work.

Fred J. Underwood is general manager of the Canadian operations, and H. B. Williams is manager of engineering.

A backlog of several jobs is now being processed for various Canadian oil and chemical companies.

Drake America Corp. to Handle Power-Light Div.

Winpower Manufacturing Co., Newton, Iowa, has announced the appointment of Drake America Corp., New York City, as exclusive export office for power-light division products. Sales and distribution will be personally supervised by Franc Finn, Drake America vice president. Products include generators, wind-electric plants, gasoline-electric plants, and industrial equipment.

According to E. A. McCardell, president, "the appointment of Drake America Corp. to handle the power-light division will expand export sales, which have averaged a third of total production in recent years."

Christianson, Gary Joins American Iron Sales Force

CHRISTIANSON

J. R. GARY

Harry Falter, Jr., assistant advertising manager for American Iron & Machine Works Co., Oklahoma City, has announced two additions to the company's sales force. Lee H. Christianson will represent American Iron in Canada as a field sales representative, and will establish his headquarters at Calgary, Alta. Jack R. Gary has been named to the Gulf Coast area, and will specialize in sales of production equipment.

Before joining American Iron organization, Christianson spent a year with Halliburton Oil Well Cementing Co., and 3 years with Hughes Tool Co. in Canada.

Gary was formerly employed with Iverson Supply Co., and Guiberson Corp. His headquarters will be the district sales office in Houston.

Taylor Instrument Announces Tulsa Sales Office Changes

Taylor Instrument Companies, Rochester, N. Y., has announced the following changes made in its Tulsa sales office personnel.

Industrial Sales Representative Joseph C. Laley, previously working out of the Houston office, has been transferred to the Tulsa branch where he is covering territory largely south and west of Tulsa.

The accounts formerly handled by Laley in the Houston area have been assigned to Edward M. Davis. After completing an extensive training course at both Tulsa and Rochester, Davis had experience in customer contact work in the Tulsa territory.

Cameron Valve Design Discussed at Houston Meeting

Continuing its program of group discussion of valve problems encountered in modern petroleum-chemical service, Cameron Iron Works of Houston was host to approximately 50 petroleum process-plant constructors and engineers at a recent meeting in Houston. Leading construction engineering firms represented were: Brown & Root, The Lummus Co., Delta Engineering Co., Grebe & Doremus, O. L. Olsen, Hudson Engineering Co., and Fluor Corp. According to Jack Harris, manager of Cameron's industrial valve division, this was the forty-second meeting sponsored by Cameron to acquaint men in all branches of the petroleum-chemical industry with the unique mechanical features of the Cameron nonlubricated lift plug valve.

Century Opens Canadian Sales and Service Office

H. B. MUNSEY

An office to handle Canadian sales and service of geophysical equipment has been opened in Calgary, according to Opie Dimmick, president, Century Geophysical Corp., Tulsa.

Effective October 15, the new office, under the direction of H. B. (Hank) Munsey, was opened in the Examiner Building in connection with Century's Canadian division. Before his new appointment, Munsey was supervisor of production, and coordinator of customer service at Century's Tulsa plant. He was previously with Bell Telephone Co. for 20 years as installation supervisor.

Earlier this year Century Geophysical Corp. of Canada, a wholly owned subsidiary, was organized in Calgary. James K. Ziegler is vice president in charge of the Canadian corporation.

Correction

J. F. BISHOP

R. W. GRONAUER

An unfortunate transposition of cuts in the December 8 issue resulted in two errors on these pages. James F. Bishop, new general manager of American Hoist & Derrick Co., was improperly identified as R. W. Gronauer, assistant general sales manager of O P W Corp., and, similarly, Mr. Gronauer's name appeared under the cut of Mr. Bishop. The transposition occurred during the process of "make-ready."

American Locomotive Co. Elevates Egbert, Morris

The board of directors of American Locomotive Co. elected Perry T. Egbert president, and William S. Morris executive vice president, at a recent special meeting. Duncan W. Fraser will continue to serve as chairman of the board.

Egbert has served the company in production, sales, and engineering capacities since 1920. He was named vice president in 1944, and has been in charge of locomotive and ordnance di-

vision operations at Auburn and Schenectady, N. Y.

Morris, who joined Alco in 1922, has also been a vice president of the company since 1944. He has been in charge of sales for all divisions.

Fraser became president of American Locomotive in 1940 and chairman in 1945. He became both president and chairman in 1950.

U. S. Steel Announces New Warehouse Facilities

WORTHINGTON

The opening in suburban Houston on December 1 of a large modern facility for the distribution of steel has been announced by Leslie B. Worthington, president of United States Steel Supply, coast - to - coast warehousing division of U. S. Steel

The new facility, the division's fifteenth, is on Clinton Road near Galena Park, 9 miles southeast of Houston, along the Houston Ship Channel. Warehouse and office space for this new installation will be leased from Tennessee Coal and Iron Division of U. S. Steel.

Worthington said the new warehouse will carry complete stocks of steel—bars, shapes, plates, strip, and sheets in carbon, alloy, and stainless grades. In addition to the stocks on hand, customers will be able to draw on the resources of the division's 14 other warehouses for items not normally carried in this area. All standard warehouse services will be available, including the most modern cutting, burning and shearing facilities.

"Actually the word warehouse is not quite accurate," Worthington said. "Steel warehouses are department stores, the retail outlets of the steel industry. They buy from the steel producers and keep their stocks in the best possible shape to meet customer requirements. These requirements change constantly. Although the size of individual consumer orders averages less than a ton, the total volume of warehouse business is a very important factor in the consumption of steel, since nearly 20 per cent of the steel produced in this country is sold by warehouses."

In addition to the new Houston plant, U. S. Steel Supply Division, which has its general offices in Chicago, operates warehouses in Moline, Chicago, St. Louis, St. Paul, Milwaukee, Cleveland, Pittsburgh, Baltimore, Boston, Newark, Los Angeles, San Francisco, and Seattle, and Portland, Ore.

Arabian Association Celebrated by Marlow

During a recent trip through Europe and the Middle East, Don Broadwell, export sales manager for Marlow Pumps, Ridgewood, N. J., took time out to celebrate the fourth anniversary of Marlow association with Mohammed Aly Mously who is the Marlow distributor for all of Saudi Arabia. Long considered a backward country, this territory is now supplementing its oil industry with a progressing agricultural program fostered by use of irrigation pumps and systems in areas previously considered arid and nonproductive.

Myers-Bagwell Names Aubrey Sales Engineer

H. S. AUBREY

Myers - Bagwell Co., manufacturers' representatives, Tulsa, has announced that H. S. Aubrey has joined the company as a sales engineer.

Aubrey spent 3 years with Dallas Power & Light Co. in Dallas following his graduation from Texas A. & M. College in mechanical engineering. He was recalled to the Air Force in 1951, and served as flight-test maintenance officer at Greenville, S. C., until his release in October of this year.

Walter O'Bannon Adds Budde, Mills to Staff

Walter O'Bannon Co., Tulsa, has announced the appointment of F. W. Budde as secretary-treasurer, and Kenneth N. Mills as chief engineer.

Budde was formerly assistant to the vice president and treasurer of Tellepsen Construction Co., Houston. Prior to his association with Tellepsen, he was assistant treasurer of H. K. Porter Co. assigned to Jarecki International Supply Co., Hinderliter Tool Co., and Mt. Vernon Car Manufacturing Co. as controller.

Mills was formerly associated with Dresser Equipment Co. as machinery products manager. Before his association with Dresser, he was assistant chief engineer of Emsco Derrick & Equipment Co., works manager of Texasteel Manufacturing Co., chief engineer of Bethlehem Supply Co. and American Manufacturing Co.

Willey Transfered to Tulsa as Field Engineer

W. T. WILLEY

G. L. Smith, sales manager, Republic Rubber Division, Lee Rubber & Tire Corp., has announced transfer of W. T. Willey from Houston to Tulsa, replacing Norman M. Grove, who recently retired from his position as field engineer.

In announcing the retirement, Smith paid tribute to Grove for his outstanding service to the company and to the oil industry. Grove has been with Republic since July 16, 1931. With headquarters in Tulsa, he has specialized in field engineering service to the oil-well drilling and oil production segments of the petroleum industry.

Williams Named Works Manager by Baash-Ross

W. J. WILLIAMS

F. L. Tooley, executive vice president of Baash-Ross Tool Co., has announced the appointment of W. J. (Bill) Williams as works manager, in which position he will be responsible for coordinating production, and manufacturing operations throughout the 17 major plants, and service shops maintained by the company in the nation's major oil areas.

Williams joined Baash-Ross organization in 1926. Since that time he has specialized in the design, development and manufacture of oil-field products, and has played a major role in developing the revolutionary new Baash-Ross pressure welding machine now in extensive use for welding broken or worn drill collars, kellies, and other heavy-walled oil-field equipment.

Williams' normal field of operations will cover all of the Baash-Ross plants through the United States, with headquarters located at the Los Angeles plant.

Your MARKET PLACE FOR THE OIL AND GAS INDUSTRY...

CLASSIFIED ADVERTISING

UNDISPLAYED CLASSIFIED 20c a word one issue. 10% Discount three or more consecutive issues. $4.00 minimum charge. Blind Box in our care nine words. Payable in Advance.

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$14.00 a column inch one issue . . .
10% Discount three or more issues.

Address Classified Advertising Material: The Oil and Gas Journal, P. O. Box 1260, Tulsa 1, Okla.

EQUIPMENT FOR SALE

PIPE
All sizes; line pipe and casing, tanks, and Oilfield supplies. Edco Pipe & Supply Co., Phone 4-5970, P.O. Box 151, Tulsa, Oklahoma.

FOR SALE: Walker-Neer Spudder S-32 Special, complete with tailing-in tools for 5" and 7" casing. Lines extra good. Dog House, light plant, float trailer. Complete tools for drilling, running tubing, sucker rods, etc. Butane equipped. Price $15,000.00. For inventory write Box 1022, Del Rio, Texas.

FOR SALE: 1—Oilwell 7⅛ x 14 P.H.D., A-1 Condition, Power Pump. 1—C150 Ideal Power Pump, A-1 Condition. 1—NKU Waukesha Motor with Twin Disc Clutch. 1—WAK Waukesha Motor with torque converter, new engine warranty. 1—21A Oilwell Oil Bath Rotary Table, Used Very Little. 1—C150 Oilwell Swivel. The above equipment is located at Greggton, Texas. P.O. Box 1987, Longview, Texas.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-38 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units Westinghouse 20-25-50 KW Generating Units

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

REFINERY EQUIPMENT FOR SALE
Ready for Shipment

BOILER—360 HP, 350#, single drum boiler, good condition, complete with steel casing and structural supports. Minimum time and cost to put in service.

REACTOR—Heavy wall electric welded ellipsoidal head pressure vessel, 6 foot diameter, 40 foot cylinder. Material .25% carbon steel unlined. Minimum shell thickness 2.4 inches. One end and two side manways. Suitable for reactor, high pressure fractionator or similar use.

These items available for inspection, Mid-Continent location.

GEORGE ARMISTEAD and COMPANY
1200—18th St., N. W., Washington 6, D. C.
REpublic 7-6338

GASOLINE PLANT EQUIPMENT

19 Atmospheric Sections
Different sizes and pressures.
3—125 HP 225# Pressure Broderick Super Heater Boilers. Complete with all controls and Burners. With Sectional Steel Bldg.
2—Pumping Units consisting of
2—8" Centrifugal Pumps Capcy. 1650 GPM.
1—8" Capcy. 1000 GPM.
1—1½" Capcy. 350 GPM.
Driven by Dean Hill Type D-4 Dean Hill Steam Turbine, 1800 RPM.
1—Sectional Steel Building 34x152x14, With Crane.

PATTON & SWAB
Tulsa, Okla.
Local 3-3181 L D 422 PO Box 1267

EQUIPMENT FOR SALE

FOR SALE: One 4'0" ID x 40'6" x 11/16" shell Tower. Hastalloy lined, no trays, 250# WP for vertical erection. Price $1,500.00. Kinslow Power & Equipment Co., 817 So. Boulder, Tulsa 14, Okla.

FOR SALE: Sullivan "300-A" drilling rig complete with 2-Buda engines, one practically new, drawworks, rotary table, 65' derrick with 20' section to pull doubles; Wheatley 7x10 mud pump, swivel, traveling block, kelly, etc. All mounted on tandem trailer. Excellent rig for drilling to 3000' or deep core drilling. Rig in excellent condition. Selling to replace with larger equipment for deeper drilling. Contact Box 1022, or Phone 813, Del Rio, Texas, for inventory and price.

FOR SALE
MODEL 1050 IDECO RIG
Powered With
Three G-M Twin Diesels

136 Ft. Lee C. Moore, Heavy, Wide-Base Mast

4½" Grade E Drill Pipe with Hard Bands Drilled Four Gulf Coast Wells.

Rig is Complete and in Good Condition.

Write Box G-166, The Oil and Gas Journal, Tulsa, Oklahoma

EQUIPMENT FOR SALE

2 FAILING Model 1500 drills, shop number 966 mounted on KBS-7 1947 International truck, shop number 909, of special design mounted on GMC 6 x 6. Both drills in good condition and reasonably priced. Write for prices and list of equipment. Box G-193, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: 40,000 ft. #1 3½" O.D. standard plain end line $0.55 per ft. 20,000 ft. 4" O.D. flues. Rogers Pipe and Supply Company, Phone 5-6850, Tulsa, Oklahoma.

FOR SALE: Standard rig—complete with tools, in good condition. Just finished Oriskany well located in Washington County, Ohio. M. N. Judson, Rural Valley, Pa. Phone: Rural Valley 3-311.

NEW STEEL PIPE

79,000 lin. ft. steel pipe, electric welded 24" diameter, 40 ft. lengths, 930 lb. test pressure, plain ends. Immediate delivery.

MISSISSIPPI VALLEY EQUIPMENT CO.
511 Locust St., Chestnut 4474, St. Louis 1, Mo.

FOR SALE—NEW AND USED PIPE

NEW—65,600 ft. 3½" OD, T & C line pipe, seamless or electric weld, 65c ft. Wt. 6.50
NEW—50,000 ft. 4½" OD, T & C seamless or electric weld line pipe, 95c ft. Wt. 9.50
Above is foreign casing now stacked at Bell Transportation Co. Yard, Houston.
USED—30 miles 6⅝" OD seamless, weight 18.97, 30 joints, beveled for welding, cleaned inside and out, $1.40 ft. Cushing, Okla. This line coated and laid in 1943.
USED—225 miles 8⅝" OD, weight 28.55, double jointed, beveled for welding, $1.85 ft., loaded on cars vicinity St. Louis, Missouri.
All used pipe subject to customer's inspection and selection. Guaranteed No. 1.

W. C. BERRY
P. O. Box 1858 Phone 3-6141 Tulsa, Oklahoma

DRILLING EQUIPMENT FOR SALE

Emsco EC Drawworks with hydromatic brake, two automatic catheads.
Emsco J-1250 compound transmission for three engine drive, with pump takeoff pulley equipped with 24" Fawick clutch; air compressor mounted on compound case.
5—Cummins Diesel Engines, Model LP 600, each with 18" double Twin Disc clutch.
2—Emsco Type JA reverse gears.
1—National Rotary 3 speed gear box, equipped with 18" Twin Disc clutch.
1—Steel skid base for three engines, 18" high.
1—Steel base for Emsco Reverse Gear.
Equipment may be inspected at our yard at 3465 Cherry Avenue, Long Beach, Calif.

THOMAS P. PIKE DRILLING CO.
417 South Hill Street Los Angeles 13, California

EQUIPMENT FOR SALE

WELL drilling equipment, new or used. Spudders, rotaries, core & shot hole drills, tools, pipe, bits, blocks, pump jacks, valves. Everything for well drilling and service. Fishing tools rented. Pressey & Son, Pueblo, Colo.

ONE Cardwell H.S. and one Franks S.E.T. single drum servicing units, mounted on IHC trucks with 65' telescoping masts. Phone 80, Stafford, Kansas.

1 Oilwell .team Pump, 16¼ x 7¾ x 20". 1 Gardner-Denver Steam Pump, 18 x 8 x 20". Both pumps are in excellent condition, may be seen at Makin Drilling Company Yard, Hobbs, New Mexico. MAKIN DRILLING COMPANY, Box 1628, Hobbs, New Mexico.

CLEVELAND Models 75, 95 & 110 Ditchers Available—Rental to apply on purchase. A. C. R. Co., 19615 Nottingham Rd., Cleveland 10, Ohio. KEnmore 1-8000.

FOR SALE: 10,000 ft. 16" OD ⅓" wall E. W. Range 3 beveled New Pipe; 10,000 ft. 7" OD 26# R-2 10V thread Seamless Casing; 5,000 ft. 7" OD 24# R-2 10V thread Seamless Casing; 10,000 ft. 5½" OD 14# R-2 8R thread Seamless Casing; 10,000 ft. 7" OD 24# 10V thread Lapweld Casing; 5,000 ft. 5½" OD 17# 8-R thread Lapweld Casing; 10,000 ft. 6⅝" OD Standard Line Pipe P.E. or T&C; also quantities of Miscellaneous Casing, Tubing and Line Pipe. Phone, wire or write Sabine Pipe & Supply Company, Phones 3094, 3095, 5533, 3436, Kilgore, Texas.

HUMBLE TYPE

1¼" PRESSURE and TEMPERATURE RECORDERS

2⅝" DRILL - STEM PRESSURE RECORDERS

OIL FIELD RESERVOIR ANALYSIS EQUIPMENT

ENGINEERING PRODUCTS INC.

(Successors to Engineering Laboratories, Inc. BHP Division)
600 E. 4th St. Phone 2-7223
Tulsa 3, Oklahoma

For Sale
Used Equipment

1—7¼x14 Model 11,000 Wheland power mud pump. Complete with 60" drive sheave and unitized with Model JL 1335 Buda engine equipped with butane equipment. This unit assembled on one set of sub-skids with mud gauge shear relief valve and suction.
1—Wilson Giant 1942 Model drawworks less engine. Completely overhauled.
1—3½x10 National Transit water pumping unit, skid-mounted with Model PA 50 International engine equipped for butane.
1—Model 34-26 National steam drawworks completely overhauled and never been run.
2—7½ KW General Electric Thyrite generators completely reconditioned and with new factory guarantee.
1—5 KW General Electric Thyrite generator, same as above.
1—National 50 3-engine V-belt compound complete with engine clutches for WAK Waukeshas.
1—Western Iron & Foundry V-belt compound to accommodate 2 LRO Waukeshas.
1—Wilson Titan internal clutch type drum assembly complete with new Lebus wire line grooving.
2—Wilson-Atlas drum assemblies complete, one with Lebus groove and one without grooving.

JOHN C. BURGE INC.
2800 South High, P. O. Box 4356
Oklahoma City 9, Okla.
Tel. ME 8-3358

EQUIPMENT FOR SALE

FOR SALE: 1850' of second hand, 28# 8" casing; located in Lost Springs, Kansas. Price $2.25 ft. Call A. Loriaux, Phone 1405W, Bartlesville, Oklahoma.

FOR SALE at Oklahoma City, Oklahoma, 13 used #8500 IBM Electric Time Recorders to be operated from Master Clock complete with card racks. Each $150.00. Cities Service Oil Co., Patridge, Bartlesville, Okla.

SIX CHAPMAN #58½—30 inch low pressure, double disc gate valves, rising stem, flanged ends. Write, wire or call. Used but like new. Continental S & R Company, McCook, Illinois.

FOR SALE: R. L. Dubbledrum Cardwell fully equipped. Oklahoma City. Melrose 8-9234.

SALES and rentals of cable drilling and fishing tools, casing and equipment, from the Southwest's largest stock of used cable tools and oil field supplies. Degen Pipe and Supply Co., Tulsa, Oklahoma.

GAS METERS FOR SALE. Westcott, Foxboro and Emco. Good condition. Geo. R. Milner, Box 124, Okmulgee, Oklahoma.

3—General Motors Twin Diesels, Model 6-71-1203. Completely overhauled; heavy duty transfer gears, starters and skids. Replaced by gas engines on EMSCO 750. OIL STATES DRILLING COMPANY, Dallas, Texas. Phone PRospect 8184; or can be inspected at W. A. (AL) HUGHES YARD, ABILENE, TEXAS. Phone 2-1911.

FOR SALE: Six Type 80 Cooper Twin Compressors. Good Condition. Alfred B. Kern, 223 Wright Bldg., Tulsa, Oklahoma.

WANT EQUIPMENT: Did you find the equipment you wish to purchase in this column? If not, use an "Equipment Wanted" classified advertisement to find it. It is available somewhere and Journal classified advertisements will find it. See box heading for classified rates, or write The Oil and Gas Journal.

7" LAPWELD CASING

11,000 ft.—7" O.D., 26#, 10 thread Long T&C, Range 4 used excellent condition. Located Burbank, Okla. Priced less than ceiling.

Mid-States Pipe & Supply Co.
Phone 2-9128 Tulsa, Okla.

FOR SALE
GAS GENERATING UNIT
500,000 cu. ft. Holder.
5 Gas Generators.
5 Igniters, 10 Ash Cars.
5 Washboxes.
3 Blast & 2 Gas Blowers.
Automatic Controls, Lubricators, Pumps, Scrubbers, Etc.
EASTERN KENTUCKY SCRAP CO., Inc.
P. O. Box 388, Louisville 1, Ky.

FOR SALE

2—255 HP, Type S Ingersoll-Rand Oil Engines, direct connected to 219 KVA, 2400 volts, 3-phase generator.
1—275 HP, PVG Ingersoll-Rand Gas Engine, direct connected to 237 KVA, 440 volt, 3-phase Westinghouse generator.

Units complete with switchboard panels, instruments and necessary accessories. Located: Chatham (Medina Co.), Ohio.

DYMO OIL CORPORATION
PO Drawer 550 Olean, New York

EQUIPMENT WANTED

WILL PAY highest prices for used casing, used line pipe, abandoned leases, or other surplus lease equipment. Your idle producing equipment is worth dollars. Green Pipe & Supply Co., Box 1383, Tulsa, Oklahoma.

WANTED: Used Lee C. Moore 98-ft. mast, 9-ft. substructure. Box G-214, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Number 28 or 36-L Bucyrus-Erie Spudder. Mail inventory and price to 132 N. Emporia Street, Wichita, Kansas.

EQUIPMENT WANTED

WANTED: Three engine compound for Wilson Titan drawworks. Makin Drilling Company, Box 1628, Phone 3-3141, Hobbs, New Mexico.

WANTED: Used sucker rods, ¾ and ⅞", used tubing, casing and steel or plastic line pipe and bolted storage tanks. Any amounts. Goodall Electric Mfg. Company, Ogallala, Nebraska.

EQUIPMENT NOT IN USE: Did you find a buyer in this column for the equipment you have for sale? Someone wants it and an "Equipment For Sale" classified advertisement in the Journal will find a buyer. See box heading for classified rates or write The Oil and Gas Journal.

HELP WANTED

OIL SECRETARY: Age 35 to 45, for independent oil company in Oklahoma City. Must be expert stenographer, well experienced in oil production and operations. Must have excellent character and references. Sal. $350 per mo. with raises commensurate with ability. P.O. Box 1824, Oklahoma City, Okla.

WANTED: Man experienced in operation of catalytic cracker for position as assistant superintendent. In replying please state age, qualifications and experience. All inquiries will be held in strictest confidence. Box G-209, The Oil and Gas Journal, Tulsa, Oklahoma.

MECHANICAL Engineer - Chemical Engineer. Opportunity for each in a petroleum refinery located in Mid-Continent area. Prefer men with three or more years of experience. In first letter give a resume of training and experience. Replies confidential. Box G-211, The Oil and Gas Journal, Tulsa, Oklahoma.

CIVIL DRAFTSMEN Needed by major Pipe Line Company in Tulsa, Oklahoma. State age, education, experience, and salary expected. Steady employment to capable men Box G-222, The Oil and Gas Journal, Tulsa, Oklahoma.

SEISMIC PERSONNEL needed for United States and Canada by well known and expanding contract geophysical company. Address Box E-863, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL Industry Employment Service. 405 Tuloma Bldg., Tulsa, Okla. 4-5974. Tom Robinson, owner. For Technical and Trained Personnel, including LPG.

PURCHASING AGENT for large, well established geophysical company. Must be familiar with all phases of seismograph purchasing. All replies confidential. Box G-201, The Oil and Gas Journal, Tulsa, Oklahoma.

GAS ENGINEER
Independent Oil Company with oil and gas properties in New Mexico and West Texas has opening for field gas engineer in its organization. Background in gas production, transmission and compression required. This is an excellent opportunity for a young man with an engineering degree and field experience to grow with an organization. Write resume giving details of education and experience. Enclose small photograph if possible. Box G-199, The Oil and Gas Journal, Tulsa, Oklahoma.

SEISMIC computer for contract crew operating in Mid-Continent area. Advancement assured for right man. Salary commensurate with background and experience. Inquiries confidential. Box G-235, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE Petroleum Engineer, with one to three years field experience, by Independent Consulting Firm. Must be industrious and responsible. In replying give information as to education, experience, and salary expected. P.O. Box 1939, Abilene, Texas.

WANTED: Geologist with major company experience in the Mid-Continent area. In reply give age, Military status and a sketch of training and experience. Tulsa probable headquarters. Box G-231, The Oil and Gas Journal, Tulsa, Oklahoma.

CORROSION ENGINEER: For work with major company in central states on pipe lines. Position requires previous experience cathodic protection work on bare and coated lines. Address Box G-233, The Oil and Gas Journal, Tulsa, Okla.

HELP WANTED

ENGINEERS, Executives, Technical Men. Salaried positions—$3600 to $30,000. This confidential service for outstanding men who desire a change of connection. Will develop and conduct preliminary negotiations without risk to present position. Send name and address for details. Tomsett Associates, 434 Frick Bldg., Pittsburgh 19, Pa.

TEACHING posiltion open February 1, 1953, in petroleum production engineering. Employment at the level of instructor or assistant professor, depending upon experience and training with salary accordingly. Location, Rocky Mountain area. Box G-232, The Oil and Gas Journal, Tulsa, Oklahoma.

THE POSITION YOU WANT: Oil industry companies are looking for men to fill every conceivable kind of position. If you didn't find the position in this column that you are looking for, use a "Situation Wanted" classified advertisement to state your qualifications. Some company is probably looking for your ability. See box heading for classified rates or write The Oil and Gas Journal.

SITUATIONS WANTED

ATTENTION: Well established oil well drilling contractor desires to manage and supervise: Individuals', groups', small or medium-sized oil companies' drilling, production and operating problems in Central and Western Texas, and New Mexico. Personal interview by appointment is desired. Makin Drilling Company, Box No 1628. Ph. No. 3-3141, Hobbs, New Mexico.

SUPERINTENDENT-PETROLEUM ENGINEER, 20 years experience as geologist-petroleum engineer in California; last five years superintendent and manager of oil field operations in California and Mexico. Speaks Spanish fluently. Desires responsible position with reliable company or independent operator. Domestic or Foreign. Box C-228, The Oil and Gas Journal, Tulsa, Oklahoma.

CONTROLLER, Tax-Accountant, 35, capable; qualified; experienced; CPA; BBA degree; five years government tax experience; four years and presently executive accountant for independent drilling, producing and recycling operations. Seeking challenging job with maximum responsibility. Box G-224, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY SUPERINTENDENT—or General Manager (Might be interested in position as Asst., Supt. or travelling operator). Experience extends through operation, construction and maintenance. Have helped build and/or start up five new refineries. Have had some foreign service. Will go anywhere in the world. Box G-213, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER — Experienced in drilling, producing and workover operations. Desires work with small company. Box G-330, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER, M.S., age 38, Texas location, desires responsible position with oil or chemical company. Formerly process engineer, refinery superintendent, independent pipeline contractor. Past 2½ years at pilot plant producing acetylene by partial combustion of methane. Present salary $8900. Box G-172, The Oil and Gas Journal, Tulsa, Oklahoma.

INSTRUMENT man, 22 years Oil Refinery Experience. 10 years as instrument man. Prefer western states. Box G-234, The Oil and Gas Journal, Tulsa, Oklahoma.

THE RIGHT MAN: Can you fill the position you have open from the qualifications listed in this column? Men are always looking for an opportunity to improve themselves. Use a "Help Wanted" Journal classified advertisement to find the men you need. See box heading for classified rates or write The Oil and Gas Journal.

SERVICES

GEOLOGICAL Consultant of Central and Eastern Oklahoma has Employed Top Caliber Geologists and Draftsmen for Compilation, Interpretation of Geological Data, Subsurface Structural Mapping and Preliminary Reservoir Appraisals. THIS SERVICE OFFERED TO OIL COMPANIES. P.O. Box 1884, Tulsa, Oklahoma.

INCORPORATIONS

DELAWARE CORPORATIONS FORMED & SERVICED. Commonwealth Trust Co. P.O. Box 350, Wilmington, Delaware.

LEASE AND DRILLING BLOCKS

FOR SALE: Oil and gas leases in Sherman Co., Kansas. 1800 acres in one block and 320 acres in Banner Co., Nebraska. Box G-216, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: 1000 acres State Leases in Guadalupe and Hidalgo and McKinley County, New Mexico. Box G-215, The Oil and Gas Journal, Tulsa, Oklahoma.

WILL pay cash instantly for leases (large blocks), royalties, mineral deeds, production. Write fully—P. O. Box 2153, Denver, Colorado.

FOR SALE: 10,000 deeded acres in the heart of the Williston Basin. 8,000 acres with 65% mineral rights. 700 head fine cattle, complete set machinery, irrigating equipment. Additional grazing land can be leased. River runs through ranch and also 11 artesian wells. Write J. C. Alguire, Box 684, Billings, Montana.

ACREAGE FOR SALE: Nebraska Salina Basin Test. Drilling soon. Offset $25., ½ mile $15., balance $5. per acre. Excellent Geology. Write or call J. K. Walker, W & M Oil Co., 116 So. 15th, Lincoln, Nebraska.

LEASE and well drilled in 100 bbl. per hour vicinity. $300.00 per 1/32. Money escrowed until sand is drilled. L. Price, Coweta, Okla.

ACREAGE: New South Dakota wildcat, good geology, title work completed, portion landowner royalty for sale. Four wells to be drilled in 1953. For full details, write Box 822, Watertown, South Dakota.

LOOKING FOR A LEASE? There will be over 40,000 wells drilled this year. If you are looking for a lease, drilling block, or drilling deal and haven't found it in this column, or if you have a lease or drilling block you want drilled, a Journal classified advertisement can find an interested party. See box heading for classified rates, or write The Oil and Gas Journal.

LEASES ROYALTIES

Producing and Nonproducing

Bought and Sold—Any Area

Inquiries Invited

B. D. BUCKLEY

6835 Delmar Ave., St. Louis 5, Mo.

ROYALTIES

WILLISTON BASIN ROYALTIES

Dealers in Montana royalties since 1921, we now specialize in royalties under major company leases in the Montana portion of the Williston Basin. For information on our method of operation, write LANDOWNERS ROYALTIES COMPANY, Box 1225, Great Falls, Montana.

JACK EAGLE—Pay you immediately for your producing royalties and Overrides, absolutely no delay, send complete details 706 City Nat'l Bldg., Okla. City, Okla. REgent 6-7027.

WILL purchase production, producing royalties or other good investments. Northwestern Oil Company, 1739 Curtis, Denver, Colorado.

PRODUCTION WANTED

WANT producing wells in paraffin or heavy oil areas where heating bottom hole fluids with Parelex Electric Heater could increase production. Parelex Corporation, Box 552, Houston 1, Texas.

INSURANCE

ATTENTION Drilling Contractors: Complete blowout, crater, submersible, water, fire, public liability, and bodily injury insurance. Complete program can be arranged through your bank. Write Box 100, Kranzburg, South Dakota.

BUSINESS OPPORTUNITIES

WANTED: Distributors, Dealers, Jobbers for flexible and rigid PLASTIC PIPE. Old line concern. Excellent opportunities. Top Quality. Good discounts. Box G-220, The Oil and Gas Journal, Tulsa, Oklahoma.

WE NEED $50,000 to help develop 1000 proven acres in major oil field. Central Texas. Additional 2000 acres (fully proven) under option. Prefer to deal with one or two parties but can accept $10,000 units, no less. This offer closes January 10th. Wire when to expect you. Edwin Young, 504 South Shaver, Pasadena, Tex.

REWARD OFFERED

STOLEN!!! New christmas tree valve from Central Pennsylvania. 10,000# test. Serial No. 51-52-10-1044. Manufactured by Oil Center Tool Company. $500.00 reward information. Box G-124, The Oil and Gas Journal, Tulsa, Oklahoma.

LEASE AND DRILLING BLOCKS

AN OPPORTUNITY TO GET IN ON THE GROUND FLOOR OF THE PLAY IN SOUTH DAKOTA

Will sell acreage and/or land owners royalty in 2,000,000 acre area slated for a minimum of four drill tests in 1953. Minimum sale: 10 acres at $5 per acre. Can offer any size block with seismograph work and geological data furnished. Will drill on turnkey basis.

CLYDE WILSON EXPLORATION CO.

Box 100, Kranzburg, South Dakota

ATTENTION
OIL MEN AND INVESTORS

Two thousand acres proven and semi-proven in Oklahoma and Kansas. Some has oil production on three sides. Fifteen thousand acres with oil and gas shows in New Mexico. Major interests for drilling and equipping $20,000 minimum. Definitely not a promotion scheme. References available. Consult your accountant for tax advantages. Address: 11451 Berwick Street, West Los Angeles 49, Calif.

Wildcats Planned

Rig arrives for first oil test in Northwest basin

THE joint Caltex-Ampel Company, West Australian Petroleum, Pty., Ltd., is continuing geophysical work in the Northwest Basin of western Australia in preparation for the drilling of its first well, probably beginning late this year.

The rig for this operation was recently shipped from the United States and beached at Exmouth Gulf using three former Navy landing craft. This was necessary because Fremantle, near Perth, the only port in West Australia prepared to unload heavy equipment, is 800 miles overland from Exmouth Gulf, in the vicinity of the area to be tested.

The rig and associated equipment were produced and assembled by National Supply Co. The rig itself was an Ideal Type 130 including a four-section diesel drive group. Also included is an independent pump drive. The rig is mounted on a three-step substructure, and the mast is the jackknife type.

The equipment is now in storage at a former navy camp being used by the company. The location for the first well is not yet definite.

West Australian Petroleum was formed by Ampol, an Australian oil company, and Caltex, and a preliminary commitment of $3,000,000 has been assumed by Caltex toward completion of the first well. The project is being directed by Carl Newcomb, who has had experience in exploratory drilling in Venezuela, Colombia, the Philippines, and Indonesia.

Dividend Payment Set Mark

WASHINGTON.—Publicly reported cash-dividend payments of oil-refining corporations in the first 11 months of 1952 hit a record-breaking $731,100,000, an increase of more than $101,000,000 over the same period last year.

Dividend payments in November amounted to $13,000,000 against $4,600,000 in the same 1951 month, the Department of Commerce reported in its monthly survey.

Refining corporation dividends this year will be topped only by those paid by financial organizations, the department figures indicated.

Central Area

(Continued from page 390)

Clinton County: W. C. McBride, Inc., 1 Phillips, NW NW SW 8-2n-3w, dry, TD 2,454 ft.

Jasper County: George & Wrather 1 Woods, NE NE SW 5-5n-9e, dry, TD 3,098 ft.

Calvert Drilling, Inc., 1 Honey, SE SW SE 16-5n-10e, dry, TD 2,944 ft.

Jefferson County: C. E. Brehm 1 Ellis et al, NE SE SW 19-1s-4e, dry, TD 2,871 ft.

Marion County: R. H. Hannon 1 Green, NE SE SW 19-4n-3e, dry, TD 3,650 ft.

St. Clair County: D. W. Forbes 1 Grandcolas, SE SE SW 15-1s-7w, dry, TD 2,233 ft.

Wayne County: W. C. Steele 1 Mix, SW SE SW 20-2n-7e, dry, TD 3,199 ft.

Calvert Drilling, Inc., 1 Richardson, SW SE NW 22-2s-5e, dry, TD 3,346 ft.

Sam Walker et al 1 Simpson, SE SW NW 29-2s-7e, dry, TD 3,476 ft.

White County: C. E. Brehm 1-F Fee, NE SW NE 32-6s-10e, dry, TD 3,070 ft.

INDIANA SUCCESSFUL WILDCATS

Gibson County: Graham Development Co. 1 Hyneman, Military Donation 106-1s-10w, IP 2,000,000 cu. ft. of gas, Hardinsburg 1,299-1,310 ft., TD 1,310 ft. (extends Union-Bowman field).

George & Wrather 1 Kingsbury, SW NW NE 31-1s-10w, IP 125 bbl., lower O'Hara 2,020-26 ft., TD 2,093 ft. (extends Patoka East field).

INDIANA WILDCAT FAILURES

Gibson County: Olds Oil Co. 1 Scott, NE NW NW 13-2s-10w, dry, TD 1,990 ft.

Pike County: L. P. Galambos 1 Hightower, SW SE SW 31-1s-8w, dry, TD 1,291 ft.

Posey County: W. W. Dayton 1 Fisher, SW SW NW 1-7s-13w, dry, TD 2,767 ft.

Sullivan County: F. B. Cline 1 Graham, NW SW SE 36-8n-11w, dry, TD 798 ft.

F. B. Cline 2 Riggs, NW SE SW 36-8n-11w, dry, TD 790 ft.

Barnes Oil Co. 1 Fountain, N½ NW NW NE 30-8n-10w, dry, 8D 947 ft.

Vigo County: Bayer Petroleum Co. 1 Labier, SW SE SW 22-10n-8w, dry, TD 2,136 ft.

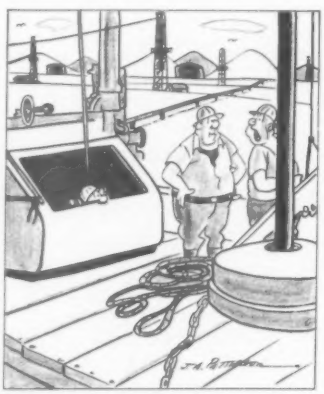
F. B. Cline 9 Crews, SE SE NW 27-12n-10w, dry, TD 1,184 ft.

Warrick County: E. J. Walters 1 Lant, SW NE SW 4-6s-9w, dry, TD 2,156 ft.

White County: F. R. Garwood 1 Horner, NE SE SW 10-28n-4w, dry, TD 920 ft.

WESTERN KENTUCKY SUCCESSFUL WILDCAT

Union County: Ralph Halbert 2 Vaughn, SW SW SW SW 19-O-19, IP 150 bbl., lower O'Hara 2,593-97 ft., TD 2,742 ft. (extends Morganfield South pool).



"They tell me this new tool pusher is an old snoop to work with."

WESTERN KENTUCKY WILDCAT FAILURES

Daviess County: J. C. Ellis et al 1 Pinkston, NW NW SE SW 11-O-26, dry, TD 2,339 ft.

Henderson County: Stanoco Oil Co. 1 Eakins, NW NW NW SE 8-P-22, dry, TD 2,680 ft.

Union County: F. B. Drilling Co. 1 Pride, SW NE NE NW 6-M-20, dry, TD 477 ft.

MICHIGAN WILDCAT FAILURES

Bay County, Williams Township: Augie Busk & Carl Grimes 1 Buczek, NE NE NW 20-14n-3e, dry in Detroit River, TD 5,165 ft., PBTD 4,550 ft. (originally drilled by Dow Chemical Co. as a brine disposal well.)

Montcalm County, Crystal Township: Columbia Oil & Gas Co. 1 Doland, NW SE SW 31-10n-5w, Dundee 3,138 ft., dry, TD 3,182 ft.

Oceana County, Grant Township: Turner Petroleum Corp. 1 Colby, NE SE NW 22-13n-17w, Niagaran 3,992 ft., dry, TD 4,082 ft.

Ottawa County, Zeeland Township: Paul Cholette, Trustee 1 Dozeman, NW NE NW 34-5n-15w, Traverse 1,539 ft., dry, TD 1,541 ft.

Kansas Fields

(Continued from page 384)

Nearest production is in the Spivey pool, 7 miles to the southwest. Location is 12 miles southwest of the Broadway pool.

National Cooperative Refinery Association has a new oil-discovery well in northeastern Sheridan County at its 1 Hardesty, SE SE NW 20-6-26, which swabbed 16 bbl. of oil during an 8-hour test with casing perforated opposite Lansing-Kansas City lime at 3,781-91 ft. Hole is plugged back from Arbuckle lime, logged at 4,168-89 ft. Lansing top is 3,736 ft. The new area is 2½ miles southeast of the Adell pool, on the Sheridan-Decatur county line.

KANSAS WILDCAT FAILURES

Cowley County: Aladdin 1 Marshall, SE NE NW 2-35s-3e, dry, TD 3,465 ft.

Ellis County: B. Brack 1 Bulec, SE SE SE 5-11s-19w, dry, TD 3,750 ft.

Graham County: Victor Drilling Co. and Deep Rock Oil Corp. 1 Grevian, NW NW NE 17-10s-21w, dry, TD 3,870 ft.

Hodgeman County: Trans-Era 1-B Sinclair, NW NW SE 10-21s-26w, dry, TD 4,495 ft.

GMR-Neumont 1 Gleason, NE NE SE 24-23s-22w, dry, TD 4,583 ft.

Jewell County: H. Mann 1 Beard, NE SW SW 10-5s-10w, dry, TD 4,052 ft.

McPherson County: Anachutz 1 Madena-Crary, NW NW NW 13-20s-4w, dry, TD 3,887 ft.

Phillips County: Jones, Shelburne & Farmer 1 Doman, SE SE NW 28-2s-18w, dry, TD 3,814 ft.

Sohio Petroleum Co. 1 Hansen, SW NW SE 33-3s-18w, dry, TD 3,598 ft.

Rice County: Dozier 1 Steward, SE SE NW 27-19s-8w, dry, TD 3,336 ft.

Rush County: The Texas Co. 1 Laughlin, NE NE NE 35-17s-19w, dry, TD 3,937 ft.

Russell County: Shelley-Miller 1 Brungardt, NE NE SE 14-13s-15w, dry, TD 3,278 ft.

Scott County: O. Parker 1 Franklin, C NW NE 3-18s-34w, dry, TD 4,892 ft.

Stafford County: Sterling et al 1 Kelly, CWL NW SE 2-23s-13w, dry, TD 3,896 ft.

Thomas County: H. K. Riddle 1 Albers, NW NW NE 26-10s-32w, dry, TD 4,770 ft.

Trego County: Jones, Shelburne & Farmer 1 Abell, SW SW SW 27-14s-24w, dry, TD 4,409 ft.

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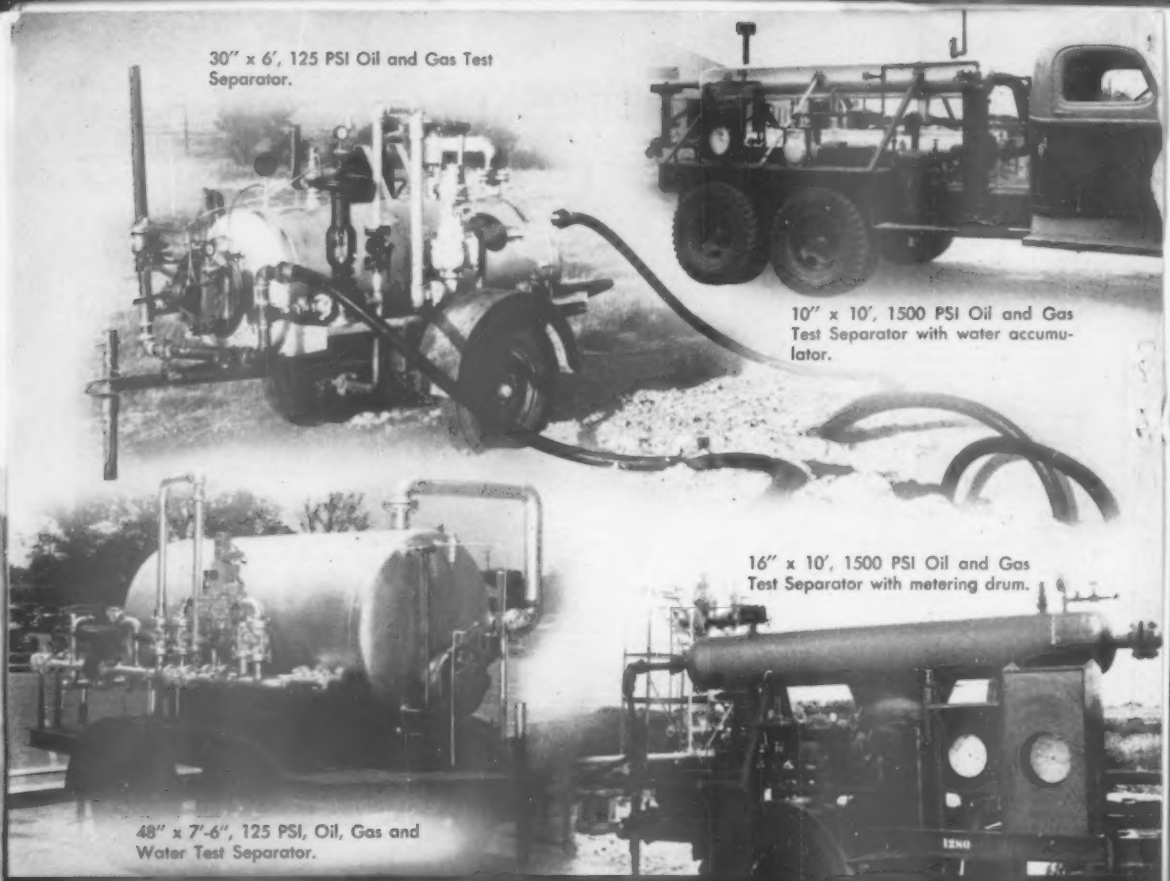

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* Means to cause an automatic increase of gas back pressure on unit if oil level exceeds normal level.

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TULSA, OKLAHOMA

17-12-52

"It's foolish to try to be bigger than you are"

REMEMBER Aesop's fable of the frog and the ox? Told 2,500 years ago, it goes:

"Three young frogs cried to their mother that a little brother had been trampled by the largest beast in the swamp. 'Oh, no,' said the mother, 'no beast is larger than I.' And she blew herself up to show how big she really was. 'But it was much bigger,' the little ones chorused. Whereupon the vain mother inflated herself until she burst." And the moral was, "It's foolish to try to be bigger than you are."

Aside from the wisdom of the fable for each of us individually, there is solemn warning for us as a nation. Some among us seem to believe that with an unlimited supply of taxpayers' dollars America can buy anything--ease and security at home, acceptance of our ideas abroad, friendship of other peoples, even world peace.

Like the vain frog, America inflates herself more and more dangerously, trying to stretch herself to be the biggest thing in the swamp. Meanwhile the enormous beast that is the world goes its own way, scarcely affected by the vainglorious display of America's inflation. It's the same old world that was indifferent before the pomp of Egypt, Persia, Greece and Rome.

How will our present "puffing" end? Isn't it obvious that continued inflation can bring disaster? Only by a realistic policy of living within our means--not trying to be bigger than we are--can America avoid the catastrophe of Aesop's foolish frog.

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